

3 June
with 1930
A.A. Stoyanov

Music Mountain west of Peach
Springs, Arizona.

The lower portion of the slope
north of the road is granite.

Lying on the granite is
about 10 feet of quartzitic
Tapeats sandstones, cross-bedded, usually
purple or purple streaked, in
other words the usual
Cambrian basal quartzite.

This grades up into a thin
Bright Angel series of typical Bright Angel
shale. It is micaceous, brightly
colored with perhaps a lot more
sandstone layers and perhaps
also lime.

This shale grades upward into
Muav limestone, which here attains
a thickness of 800-1000'. Compared
with the Grand Canyon the main
difference noted, in general, was
the true mottling rather than
subly structures. The mottles
are yellow sandy patches,
either in the form of Spiranellas
blotches or worm tubes. Some of
this bed resembles the "wormy"
Eldon of B. C., except that the "tubes"
(irregular) are yellow and not

Music Mt, (cont)

white.

Much Girvanella occurs here. It is a little larger than is usual for the M.C. type, but otherwise quite similar.

Trilobite fragments (unidentifiable) occur in the lower Muar as well as in the sandy layers of the underlying Bright Angel.

Devonian follows.

[Dr. Stoyanov has measured section]

5 June
with
AA Stogamon

East of Del Rio, Arizona.

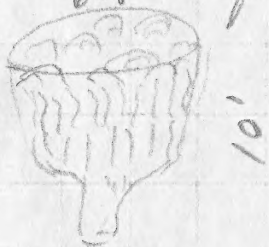
On the edge of the plateau at this place, the granite is exposed, overlain by a sandstone like the Tapeats Shale which is succeeded by Devonian limestone.

A little to the north of this first locality a thick series of metamorphosed quartzites intervenes between the granite and the Devonian sandstone.

Algae in Chuar series.
Naukorecep-

Lowest Simply crinkly bedding. Up to several
Exposed. feet in thickness.

Occurs above white, strongly crossbedded,
base forms coarse ~~sd~~ sandstone. Forms layer
perhaps 10' thick over whose rounded masses
the overlying shale is laid in sharp folds.
In the lower part of the formation the
individual colonies are small rather
irregular cylinders which sometimes bend
rather sharply. These cylinders show
the regular *Cryptozoon* structure
and widen a little as they grow.
Taken together they form large masses
that are described below. In the upper
part of the bed the small cylinders
give way to large rounded heads.
Both the cylinders and large heads
combine to form huge vase-shaped
masses. Usually the base is narrower
than a regular flare would require.



Walcott makes a good drawing in
his note book. Sample of the small
tubes taken.

Alga (Chiron) com.

upper zones. Irregular broken, usually blackened algae. Some appear to have been turned over by the waves.

Above this zone there is an oolite layer that is usually altered to black chert. The oolite

Topmost limestone has very little algae. All are indefinite and broken.

19 June

1930

with E. D. McKee

Kaiabak Trail.

Above Power house.

Tapeats typical in character and
thickness

24 May
with 1930.
A. A. Stoyanov

Nankowap Creek,
Lower Portion. [Box canyon
above Colorado R.]

Beds tilted toward river at about the same angle as the stream grade, in consequence the creek flows in the Muar almost all the way.

Just above the box canyon on the west side the Muar is faulted against the Tapeats - at x in a thin



sandy layer I got fossils - Dorypyge. Dr. Stoyanov and I agreed, after considerable search that these are actually in the Muar, which therefor proves conclusively that this formation is Middle Cambrian as we had previously deduced on theoretic grounds.

Recent Algal deposits in
Mankowcap Canyon.

Gravel and sand along stream
either above or below the water level
is cemented.

#

Below camp in side canyon a seep is depositing
much lime.

#

At camp springs are depositing lime
white spongy type with leaves and stems
enclosed.

#

Elsewhere where water first issues
tufa usually occurs.

Arizona
Grand Canyon
Walcott 1879

~~P. 8~~
8375

Chas. Walcott
U. S. Geological Survey.

0.591
0.364
0.227

8375

Notice strata at summit of
Carboniferous, also character
of bedding throughout.

only
young
fossils
found
in
this
stratum
is
the
same
as
in
the
lower
part
of
the
series
and
is
very
characteristic
of
the
Carboniferous
system
in
this
region.

Aug 12th 79.

7

ascended hill directly west of
Ranch at 200 feet (aneroid) above
the level of the stream found small
shells in ^{marlyish} red sandstone and 25 feet
above is the remains, both fossils
evidently of two species. spent the
afternoon searching for them.

Aug 13.

Hills 3 miles S of Ranch.

(1)

Brown soft shales, crumble gyssiferous
resting on sandstone colored 90 feet
shales

3. Massive layers, sep by fine
shale, + an asphaltum bearing into
thin shales, ^{chocolate} brown 50 feet

3. Massive

Reddish brown shale

30 feet.

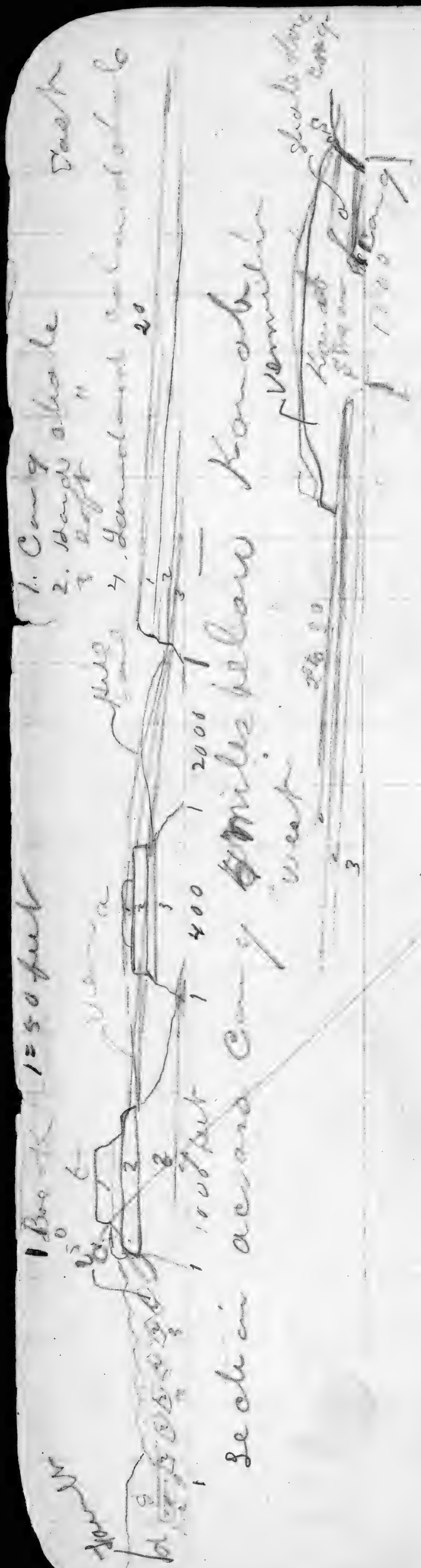
light colored sandstone
selected wood 50 ft
this is overlain by a sandstone
similar to the
rest of sandstone
Thickness - 20 feet to summit of
hill (Section Continued at p 6)

From the summit to the open
valley, the sandstone is capped with
limestone. From the
west from the east side of
the sandstone valley 4 miles
along the top. The
of the limestone. The
me one above the other
to the east & west of
the canyon.

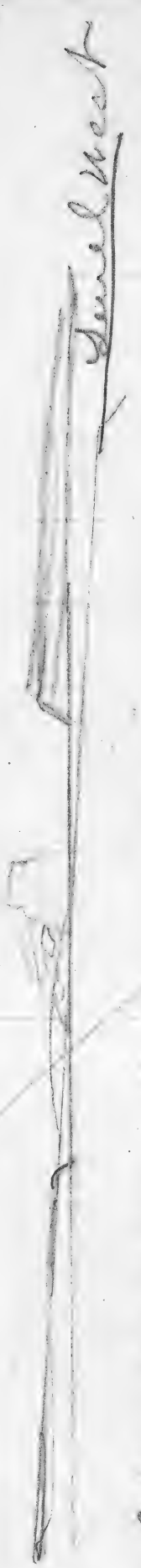
The Shinarump Canyon
is a deep, narrow
a valley (really) with
on the hills a
back to the
to the west it passes

sandstone (3) The Canyon
consists largely of a coarse
grained, unevenly bedded
small quartz pebbles sandstone
though it is irregularly
with an occasional thin bed
of pebbles, but the
thickness. The pebbles are
above the sandstone
and broken pieces of pebbles
in the sand. Some fragments
are rolled, some (are)
others are angular. Some
+ some (are) are
are now in the sand except
where which there was a
pile of selected wood
in the sand. The fragments
fragments 10" in diameter & 2" in
length are small but
all water worn & polished.

Dip of Canyonate bed N. 175°
" " " " " "



4



Line of fault 2500 w of N.

Section 1.

The Conglomerate ⁽⁵⁾ gradually rises forward the ~~west~~ until a break is met with on the ~~west~~ side of the valley this results from denudation. The strata are nearly horizontal but at (a) + (b) slightly tilted. At (c) there is an abrupt break & down to the W of 125 feet below (d). The line of the fault could not be accurately determined but it is not far from (d) of it.



Con of section (b) from page 12)

In a distance of two miles directly north across the valley the strata are buried beneath sand + decomposed rock (shaly sandstone + gypsiferous marls). Began measurements with Locks bench at first appearance of banded marls (decomposed, in long low foothill running south from ^{3rd} Cliff (Headland) W of Kanab canon. To the base of the cliff the strata are composed of slate, dark purplish brown, greenish + bluish colored gypsiferous marls which have decomposed + formed low rounded foothills on the cliffs or else stretch out as a level plain to the conglomerate. The marls are variegated in color and contain both nodules + layers of nearly pure gypsum. Thickness of measured section 350 feet.

The base I have taken for the Vermilion Cliff. This is a band of sandstone. The lower part is

(7)

5850
5-375
20

light colored ~~silt~~ (silt) overlaid by ~~the~~ reddish-brown sandstone. The layers are from 2 to 7 feet in thickness, total thickness of stratum. 20 feet

Succeeding this there is a mixed mass of marls and shales and layers of soft ~~light~~ reddish-brown sandstone (total) 70 feet. This is succeeded by a mass of R.R. Rd, which is soft + easily disintegrated. Numerous thin partings of shale + sand break it into layers of from 1 to 6 feet in thickness. (Total 120 feet)

Total to base of fish beds
Locks line 210
Amerind 200+
An 5975

The upper portion of these red beds are more compact + thicker. The lower 150 feet of the above 210 are nothing but passage beds to the Vermilion Cliff from the Shivamuk Gh.

At this point there are 3 light sandy layers with shale (4 ft) parting & then 6 feet of fine argillaceous & sandy shales they vary in color from lead through brown to red with fillets of greenish color, as yet this formation has not but a few fish scales.

This bed is separated from a somewhat similar one above by a narrow band of fine light colored sandstone varying in thickness from 2 to 4 feet in thickness. The entire band varying from 20 to 50 feet in thickness. This band is strongly defined on all the prominent headland jutting out from the main cliff, appearing, resembling a striped ribbon on the face of the red sandstone wall. As the massive strata above & below frequently

present a bold escarpment. It is also of unusual interest as to the present time it has afforded more fossils than any other stratum & also the first above the Shinarump conglomerate. (25 feet. Massive light colored brown layers, 50 feet)

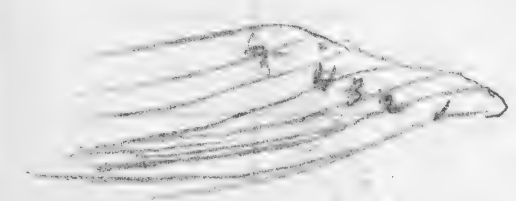
The cliff is again divided by bands of argillaceous shale and thin beds of sandstone. This bed varies in thickness at this point marked by the section it is (fish bed) 25 feet. This is succeeded by bedded sandstones varying in shades of red & light colored sandstone extending by the red color washing from above. The layers are irregular in thickness & color. This formation is of soft rock

etc. ~~Sedimentary~~ ~~formations~~ also
penetrate the beds in many
places. Some especially
abundant the rock is, often
of a yellowish cast. Thin
beds of conglomerate occur
but not of high tone.
To the summit of the first
white capped cliff above
the second ~~cliff~~ ~~level~~.
bed

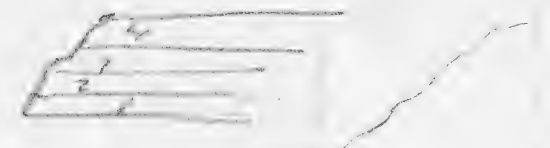
230+

This level is the one on which
the signal tower on the
headland East of ~~the~~
is built. It marks a readily
recognized horizon + divides
the lower portion of the
group from the more unde-
rstood beds above.

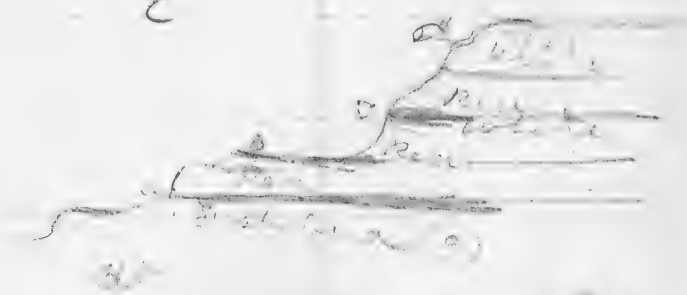
Aug 18th (11) Am 6175
Section of beds above conglomerate
S \nwarrow W of Kanab. Did not make
section here as there is a break
as great as the at this section
taken E of Kanab. 2nd A.M. of Kanab
a fault breaks the line of cliffs.
The western cliff terminates in
a somewhat bold escarpment.
The interval between the cliffs
to the hills is cut out in a
shallow valley rising rapidly
to the north.



W



E



The top of the ~~cliff~~ ~~escarpment~~ rises a very
little ~~higher~~ ~~than~~ ~~the~~ ~~level~~ ~~of~~ ~~the~~ ~~foot~~ ~~of~~ ~~the~~ ~~cliff~~
is easily seen as a ~~small~~ ~~about~~ ~~1 1/2~~ ~~miles~~
distant. ~~It~~ ~~is~~ ~~not~~ ~~likely~~ ~~to~~ ~~have~~
a dip of ~~more~~ ~~than~~ ~~5~~ ~~degrees~~.

Aug 23 d) Continuation of section
from Page 10.

The light gray ^{2d} ~~coarse~~ ~~of the~~
~~horizon~~ a ledge of redish sand
about 20 feet thick. It is a persist-
ent feature in all the cliffs
about Kanab & may be seen
up the valley for two miles
whence it disappears owing
to the dip & the rise in the
bed of the valley.

The section is taken up, two miles
above Kanab, just above
the point of the.

The strike of the strata appear
to be a little S of west (S.W.)

The dip 1.75° N.W.

Above this rock 180 feet of dark
red sandstone with thin layers
alternating with shales &
readily decomposing. It is
marked with a few
water doing formation.

The light bed at the top
commences to fracture with

above this, forming the same
rule as at the base of the Gp.
It is when the character of the
successive dominion commences
to predominate the line of
separation between the Kanab
red & white cliff dominions
of the — ? Gp. is
placed here. 20 feet of
bedded sandstone (light colored)
followed by a massive layer
of light gray sandstone
which is slightly green-
bedded. This is a strong
well indicated horizon all
along the dip of the
& up the same for miles.

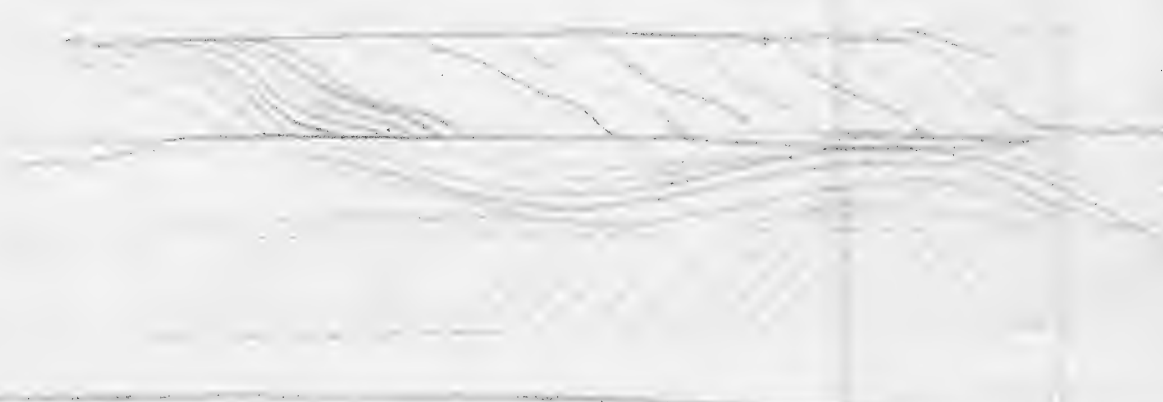
White cliff Gp.

Evenly bedded light gray
sandstone 20 feet
Massive strata heavily
cross bedded 20 feet
Light colored, light gray
with occasional reddish beds

(14)
irregularly intercalated 300 feet.

The upper portion of this mass consists of a light colored, ~~fine~~ ^{coarse} sandstone (easily disintegrated)

There are some beautiful thin strata of cross-bedding in this upper portion. Usually the bedding lines coming obliquely down to the strata.



Some evidence of cross-bedding is also seen in the lower portion.

Among the thin beds there are some very typical sandstone structures.

The weathering of the sandstone is very different from that seen between the light colored sandstone and the shale.

The thickness of the sandstone is 120 feet. The lower portion is more massive.

(15)
a view of the west cliff at the mouth of the Kanab Canyon. The cliff presents the following outline.



The white sandstone is divided into six principal beds by subhorizontal partings of more indurated shaly sandstone, which separate the crossbedded massive layers. The latter are not of uniform thickness at all places, varying from 20 to 60 feet but the divisions are readily seen on all mural cliffs.

Aug 27th

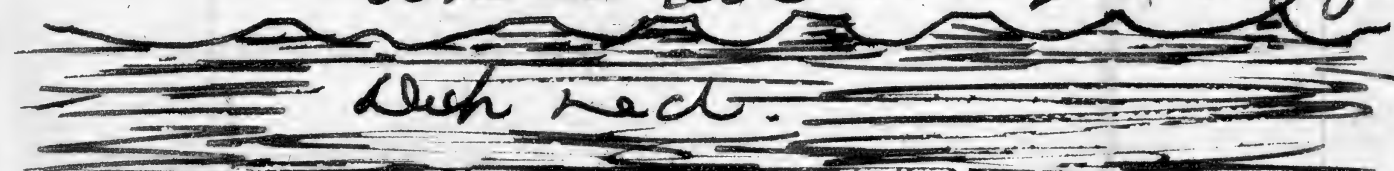
(16)

Tracing the red bed in the main canon & also in many of the lateral canons it is seen to be a uniformly bedded deposit. A number of thick layers alternate with the chaly beds until towards the summit where the thick beds are indurated & present a strong dark brown colored band beneath a ~~deposit~~ stratum of (horizontal) light colored gray sandstone which is succeeded by curved & twisted layers & then by the crossbedded sandstone. This red bed is a result of the ~~confirmation~~ of the conditions which formed the red beds of the Shinarump & Vermilion cliff type. In the Kanab & lateral canons it is usually capped with a layer of calciferous sandstone. All the strong ~~features~~ of the canon are from

(17)

appear from this horizon.

Continuation of section above red bed. Aug 28" 79. The red bed is ~~succeeded~~ ^{capped} by a coarsely deposited layer of fine grained ^{dark} red sd. usually streaked with white from the cliffs above. The upper surface of this stratum presents the following aspect when exposed on a freshly broken surface.

White sd on higher buff

 Dark red.

The two beds were closely & intimately united showing that the white sand followed the red with-out ~~an~~ ^{an} ~~interval~~ ^{interval} of time.

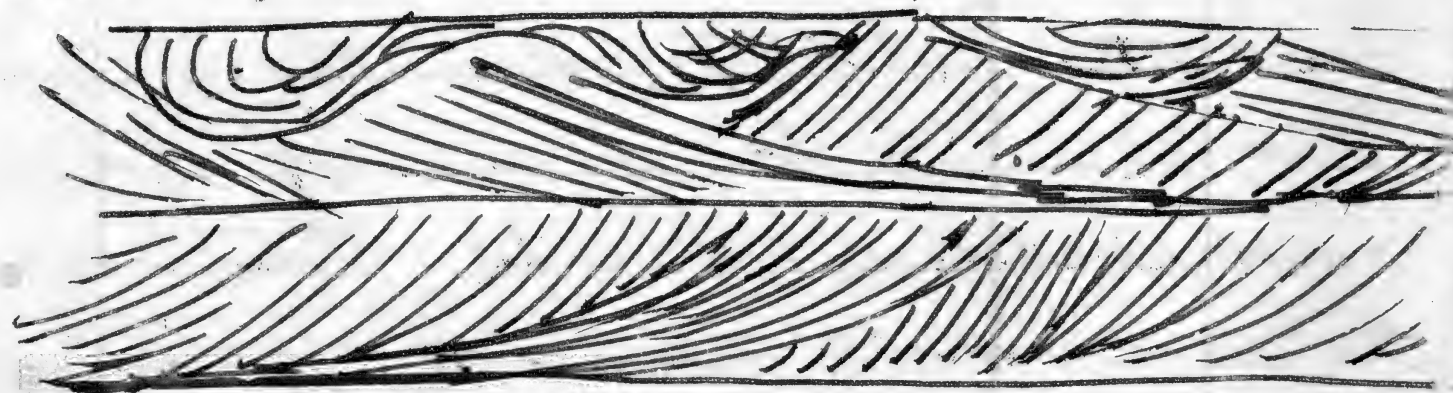
The buff bed is succeeded by a mass of beautifully banded ~~horizontal~~ & buff sds. cross & evenly bedded.

Next comes a great mass of redish & whitish cal. sds

They extend to the vermilion colored beds beneath the white cliff. They are composed of several thick bands divided by horizontal ~~surface~~ lines separating it into beds of from 25 to 100 feet. The beds are composed of evenly bedded layers of from $\frac{1}{8}$ to 1 in thickness. The thinner layers predominating. Occasionally a thicker layer ($\frac{1}{2}$ to 2 feet) occurs but it is usually irregular & of shitt. horizontal extent. At various places in the strata, usually near the summit of one of the crossbedded bands the layers & curved & twisted, giving a gnarled & knotted appearance. The faint examples are seen when it appeared as though the hollow had

(19)

of an uneven sealed had then filled up & leveled off to make way for the floor for the succeeding stratum. Thickness of beds from Red bed to vermilion beds a base of great white cliff stratum. ~~400.~~ Vermilion bed in flat. ~~700.~~ To base of White sd in cliff 1100. The buff, gray & reddish brown layers are intermingled & also deposited in irregular bands. The deep red Vermilion beds predominate towards the summit of the mass 350 feet above the base red bed.



The ^{5th} 700 feet of strata crossing the interval between the headwaters of Kanab creek (springs below White Cliffs) is c. b. s. d. red, brownish red, vermilion with an occasional fillet of white. The upper portion merges into the white cliff sed by an irregular line of contact & union, the change is in the color.

The upper 400 feet is mostly of a vermilion hue & is a soft easily disintegrated s.d. Many low foothills below the cliffs. The ^{white} cliffs all present a mural surface to the south and large masses are separated as buttes. Above the vermilion bed, which is a somewhat fluctuating horizon the true light gray or white cliff forms

Massive light colored divided into fine principal beds each consisting of fine. crossbeds 575 feet.

Capping sandstone of a reddish hue. 100 feet. Upon this rests a limestone containing fossils. Notes of white cliff sandstone.

Section II. Upper Kanab.
Buff sandstones etc directly
west of Pink Cliffs.

(1)
a. Buff sandstones (hard) alternating
with clays & marls.

a. Marls & sandstones: hard
and not readily disintegrating. $\frac{30}{25}$ feet
b. Hard buff sand 20 "

c Alternating bands of marl or
clay (weathering of purple. lead
color & white or light gray)
& buff sandstone 100.
at this point found fresh
water shells in a bed of
light clay. 20 heavy bedded
Buff sd $\frac{30}{170}$.

d. Heavy beds of buff sd. 30.
with fossils shells &
plants.

2
8. Light layer of sd + 60
clay

Heavy bedded buff sd with
fossils. The fossils
occur in a calciferous sd
which occurs in a some-
what irregular beds near
the summit of the mass and
also again 50 or 60 feet
above the clay bed beneath.
Thickness to clay bed of

155 feet

g An irregular bed of clay
+ fine buff sd. Clay bed
contains fossils.
Plats on surface 10 feet.

h massive buff sd 8

i clay + sd as h)
layers containing
corals, fossils a few shells
at base in dark clay 12

2
j massive sand buff 15

k Soft fine sand with
purplish clay beneath
holding fossils. 30

l massive buff sd with
one parting of clay. 25

m White sand with
bed of fine conglomerate
near the summit 170

The section down to the white
+ conglomerate is on a horizon
thin of buff sandstone with
clay bands. In some places
calciferous layers, persistent
only for short distances, still
seen on the same horizon
at different localities and
met with holding fossils.
Fossils also occurring in the
sandy layers.

usually in poor condition
 + Blake to be broken in getting
 them out. The ~~stratified~~
 fine yellow sand & clay in
 the back matrix for some
 etc. The ~~stratified~~ ^{thin} ~~beds~~
 colored clay weathers to a
 light grayish blue or light
~~blue~~ below. The conglomerate
 at the summit of the
 is from 15 to 20 feet in thickness
 + fragmentary as far as ~~the~~
 examination has yet been
 made. The light gray or
 white sand ~~thin~~ ^{thin} ~~layers~~
 usually has ~~some~~ ^{some} ~~of~~
 cliff ~~work~~ ^{work} ~~so that the~~
 exposure of the ~~upper~~
 is ~~not~~ ^{not} ~~seen~~ ^{seen} ~~from~~
 ridge ~~in~~ ⁱⁿ ~~the~~ ^{the} ~~vicinity~~

(M)

At the base of the ^{white} sand
 there is a heavy ^{iron stained} ~~flattened~~
 15 to 25 feet followed by alter-
 nating shales & clay for
 a long distance. The clays
 are undrained the sand
 is ~~not~~ ^{not} ~~an~~ ^{an} ~~accurate~~
 divisions of each in-
 practical to.

Between thick beds with
 marlous clay parting is
 15 feet in thickness.

Fossils ~~have~~ ^{have} ~~been~~ ^{been} ~~found~~
 remains are scattered
 through the sandstone, fossils
 were taken at 375 feet above
 white sandstone (marks of
 n 375) ^(500 to 600 feet of white hill)

Below the 500 foot level
 the rock becomes more shaly
 for the succeeding 200 feet.
 A heavy yellowish or gray
 shaly stratum, fairly ~~good~~
~~bedded~~ ^{bedded} ~~is~~ ^{is} ~~seen~~ ^{seen} ~~at~~ ^{at} ~~the~~ ^{the} ~~base~~ ^{base}

Below white sd - 800.
This is followed by a coarse
sd. yellow, iron stained in
narrow bands & below white
or gray. a few pebbles
are scattered in the coarse
upper sand. 75

The disintegration of the
white sand leaves an
escarpment below which
is prominent in all the
hill sides. It is the top of
the *Astrea* bed.

The upper sandy shales
(10 feet) contain few shells.
Below a small species is
found with a few of the
narrow elongate form
& also small brachiopods,
Gastropods etc. 25 feet.

The ~~orange~~ bed yellow sand
filled in places with
the shells lies below,
40 feet.

The central portion is a
soft yellow sd & in the
elongate *Astrea* is so thickly
placed (mouth up) that the shells
touch each in in great masses.
This bed is from 2 to 6 feet in
thickness & persistent as far
as yet examined. *Exogyra*
was seen lower in the
bed but was not seen with
the elongate form. A curious
commingling of fossils occurs
in the 40 foot bed. (Recollections).

Chick's note on (M. Sept 27th 79)
Above the *Astrea* bed
there is a bed of
bituminous shale with
a few thin pieces of *Astrea*
the houses up into an arg
shale & then in soft white
sandstone.

30
 Link Valley Camp. Sept 15th
 7 A.M. 7550.

a 9200. Base of Canyon

b. 9150. Base of b.

c 8875 175
 Base of c.

Adding with 30 to 8875 = 8975
 d. 8350 - 125

with 25
 150

8850
 c. 8875 - 275 + 25 = 300
 West Hill 8600.

Top of hill, base of f. 1/2 mile
 south 8625

Line with strata in hill west
 east 8125. Top of Henryland
 of Buff sd. 7925.
 with 250
 700
 250
 950+

7925

Sect III

Section north of Clabert.
 Sept 15. 1879.

Pink limestone

Bandstone grayish, colored
 pink by wash from limestone
 conglomerate at base 50 feet.

a 50
 Inclined sandstone.

yellowish brown 15

Light colored sandstone at top
 with portions of lead to
 purplish colored clay sandstone.
 150

c Buff sd. massive in layers
 + also shaly midway with
 slight portions of marl. 175

d. Massive buff sd. 25 feet
 underlain by buff sd
 + a thin bed of marl intercalated
 at intervals. 100.

e. Buff sd with Calcareous
 strata containing fossils. 10.

strata below section bed on side
valley sides.

Massive sd followed
by clay etc. Slide not
continue in side valley but
went 3 miles east.

7925.

Sect III

Section north of O. Nelson
Sept 15. 1879.

Pink limestone

Sandstone grayish colored
Pink by wash from limestone
conglomerate at base 50 feet.

a Indurated sandstone.
yellowish brown 50

b Light colored sandstone at times
with patches of lead &
darker colored clay sandstone.
150

c Buff sd, massive in layers
& also shaly midway with
slight patches of marl. 175

d. Massive buff sd 25 feet
interbedded by buff sd
to thin bed of marl interbedded
at intervals. 100.

e. Buff sd with Calcareous
stratum carrying fossils. 60.

Below this there is a succession
of massive buff beds with clay
parting's denoted by weathered
clay on sloping outcrops on
hill side to a massive buff
bed about 25 feet thick
which rest immediately above
a fine conglomerate &
white sandstone. 300.

Below white sandstone with the
fine conglomerate at 150
the bed extends down to
a heavy dark buff layer
175.

Below this there is a succession
of buff beds with a few
clay beds the lower
central portion is more
shaly & below a white
coarse sandstone occurs.
460

g. At 19) a yellow sand
contains an elongated form
of *Astraea*. Numerous shells
occur in a layer above
& below. 40.

h. *Massive buff sandstone*
One half mile south of the
same bed is intermittent
fossils. It has the same
lithological character but
along an outcrop of 2 miles
no fossils were seen.

i. *Massive buff sandstone*
50

j. Soft sandy layer
passing into an an-
chale & then into
argillaceous shale with
a semi bituminous
argillaceous shale
with coralloids
nodules ^{near the} 785 feet

Red shale breaking into
angular fragments 10 feet

~~The red shale contains~~

Soft sandstone, buff with
an intercalated mass of
lenticled red shale in a
matrix of intrusive volcanic
matter. The shale is broken
and is embedded in the
sandy sandstone at all angles
and in every shape. The
mass is two feet thick
in places.

Section below not
taken.

Comparatively few fossils
seen in the line
of this section both the
lenticled & the red shale
were devoid of fossils with
slight exception.

Notes on strata described
above the massive sandstone
of the Astrea bed there is an
exposed mouth of blockstone
an argillaceous shale with
a bed of dark brown shale
six feet from the base which
contains crystals of schist
and fossil shells. A bituminous
shale occurs above the sandstone
then an argillaceous shale
forming the base of the
bed to a thick bank of
sandstone 50

100 feet
~~Section~~

Nearly the same mass in
occurs above the Astrea bed
in the Kanab Canon. Examined
on a other outcrop. Sept
27th 1879.

36

37

Carbonaceous restricting the
Jurassic to the 215 feet of limestone
and sandstone

- 1. Sandstone in white
beds. Limestone of white light
sandstone.
- 2. Buff to cream colored
fine grained *Calymene* sd.
in layers from 1/2 to 1 foot in
thickness. Ripped ~~marked~~
and resting on coarse coarse-
bedded light gray sd. 55 40
- 3. Shaly layers sd. 60 65
- 4. Limestone band 10
- 5. Shale sandy
shaly, sandy layers 50
25
- 6. Cream colored limestone
with fossils 25
- 7. Reddish grayish sand
See pg 39 25
8. Coarse conglomerate
formed of the fragments 50

rounded, rolled sandstone
limestone. siliceous pebbles,
etc. principal ^{siliceous wood,} calcareous
unit with some sand 115.

b. Bed of gypsum with small
gypsum in thick layers 30

i. Low redish mud hills ^{all mud in places}
with remains of con-
glomerate on the sides
indicating decomposed
conglomerate. 200.

j. Arenaceous. gypsiferous
mud. cream colored.
banded with red & greenish
arenaceous bands. Capped
with a yellow buffed 325

k. The sand is about 2 feet
in thickness & holds
leaves etc. this is followed
by a band of clay, dark

from cutaneous vegetable
matter & weathering to a
purplish brown.

l. Another band of yellow
sand followed by light
colored mud ^{240 feet}
dark bands
of clay no coal found. 20

m. ²⁵ Yellow sandstone weathering
white with a dense argilla-
ceous shale with a band of
imure lignitic coal, with
shaly partings. 4 feet thick.
succeeded by a layer of
mass of partially carbonized
vegetable matter. 25.

n. Yellow irregularly laminated
band of sandstone 3 feet
followed by micaceous
clay bands, dark weathering
dark 25

l. Massive partially c. b.
 buff sandstone. Below zone
 evenly bedded centrally. It
 hard calciferous layers
 very irregular oval.
 Contains leaves etc. 25
 Shales dark brown parting
 with a thin seam of dark
 shale occur near the
 upper portion between the
 thick layers of red 25:

m. Argillaceous shales. Hardening
 into layers of from 2 to 8 in
 thickness, breaking in angular
 fragments. Contains shells
 etc. 30 feet from summit of
 this bed there is a seam
 of coal 3 feet thick & 6 feet
 below another of 9 feet.
 Clay shale beneath each.
 To next buff red 25:

n. Heavy buff red. Soft near
 base. It more indurated above
 scabbiness being occur in the
 lower portion. The upper
 layer is a deep yellow. This.
 Top of hill covered with
 volcanic matter.

To top of red

25 25

o.

10 feet of bituminous shale
 followed by a light colored
 sandstone holding numerous
 fossils 20 feet. Up to the
 present examination of
 over 5 miles of outcrop
 on the line Kanab valley
 there is here a concretionary
 layer of volcanic matter
 which follows the line
 of red shale which
 holds some fossils as
 in sand below. This
 is succeeded by a white
 sandstone in thick

The volcanic matter is
 seen in the same position in the
 south side of Kanab valley.

48
irregular layers 20
feet.

Bituminous argillaceous
shale with concretions
nodules containing *Dynorthis*
Baculites etc. etc. ^{Small *Exogyra*}
in bed. 80

9:
10 feet of drab colored
gypsiferous mud followed by
90 feet of soft yellow sandy
shale which is capped with
harder sandstone at top 108

Note. It is more argillaceous than
bituminous. The nodules contain-
ing the fossils vary from 8 in to
2 feet in diameter & are usually
flattened. They occur about
20 feet from the base above
there is another stratum of
nodules of a more crystalline
character with but few
contained fossils.

97
The sandy shale continues
across the low flat between
the South & north sides of the
road leading from town ab
to Little Valley and is again
taken up in the foot hills on
alopes of the hills to the north.
Concealed partially, soft sand
shales & arenaceous clays
ca. 150 feet. (Estimated)
70 feet of arenaceous shales &
then there is 475 feet of 200
feet of drab colored argillaceous
shales followed by 275 feet
of arenaceous shale with
argillaceous bands the
whole marked by fragments
of vegetable matter in
places slightly gypsiferous
The upper portion is changed
into a fine sandy shale
with a drab clay
at the top.

Massive buff sand
underlying (at least)
50.

Note for Q. On the pink
valley side there is a layer
stratum of soft coal 4 to 6
feet thick beneath the
sandstone in the bituminous
shale. It was also seen
in a ravine on the Kanab
side above Silver Lake place.

Note on sp. The nodules with
fossils were found at the
same geological horizon
on the Pink Valley side.
When exposed to the weather
the nodules break off in
many pieces leaving a soft
matrix. The small pieces of
fragments can then be found
on many small knolls in
hills.

Partial section of lower
coal bed. Pink valley
side resting on white sand-
stone which passes down
into arenaceous clays etc.

- | | | |
|---|---|----|
| 1 | Buff sand | 2 |
| 2 | Bituminous shale | 20 |
| 3 | Sandstone | 2 |
| 4 | Arenaceous shale | 20 |
| 5 | Black bitu' shale | 12 |
| 6 | Clay bed | 3 |
| 7 | Coal seam. Dense
with lignite. ^{light}
brownish coal on
passing into brown
lignite | 9 |
| 8 | Clay shale. brown to red | 50 |

9	Limestone	1
10	arenaceous clay	23
11	Shale	5
12	Gypsiferous clay	23
13	Coal	15
14	Ar + arg shale	45
15	Red	10
		197

This corresponds to K. 1, 2, 3, 4 etc
of section from the Jurassic
up taken on the Kanab Valley
side. The upper coal bed
of that section are circled
in this. K² contains the
coal seams (7).

Section from the summit
of the White Cliffs on the
west side of the Kanab Canyon.

Jurassic.

a. Limestone, mostly bedded,
gray, very hard, little mic.
under the hammer.
Contains fossils in the lower
shaly layers.

b. Limestone. Crinoidal
gray + purple, marked with
disjoints passing down into
a limestone band and again
sandstone to the top of the
u.c. sandstone.

The purple gives way to
white + the yellow comes
beneath. There is no
determined way to this

c. Solid cliff u.c. s. p. 115.
85.

b. Similar in bed c. b. soft
readily distinguishing sd.
extending across bedding.
600 — 700

c. Gray to red bed c. b.
red massive + divided
in beds from 20 to
100 feet. 300

d. Red evenly bedded
Red - a Red bed (9) massive
125

e. See pg 16
Gray sandstone to
red band. ~~in same~~ 320.

f. See pg 15.

g. evenly bedded.
h. g. Massive stratum
partially c. b. 20

i. h. Light red color
evenly bedded sd
with thin layer
of gray sandstone 20

i. Dark red sandstone
massive layer alternating
with shale. soft to
distinguishes easily
from a sloping
beds above the gray
sd beneath (pg 12) 100

j. Light gray sd 5

k. Bedded sandstones
varying in various
shades of red + gray.
The layers are
irregular in thickness
and are decorated by
partings of less in-
dicated sd. 230.

l. Thin layer of sandstone
alternating with beds
of argillaceous shale
fossils fish teeth etc 20

m l massive ^{reddish} brownish
layers. 50

n m Alternation of sandstone
layers + argillaceous
shales holding fish
remains etc 25

p n ^{Pg 8.}
Blue + sandy
shales with thin

a ² Reddish brown sd
easily disintegrating
with fragments of
shale breaking into
layers of from one to six
feet in thickness 125

f o ^{Pg 7}
Muds + shales with
bands of sd. 75

jk Reddish brown sd with
white sand above 20

or 2305.

Sh. unit.

a shale ^{greenish} gyttiferous.
Dark purplish brown.
green + bluish green
disintegrating from
ing bare footfalls. 650.

b ^{Pg 6.}
Gray conglomerate
^{Pg 2} 50

c Reddish brown shale 30

d massive layers sd ³⁵
separated by fossil.
shale Pg 1. 30

e Brown soft shale
gyttiferous ¹⁵ 90

f Light colored
arg. shales ¹² 120
^{Top 5550 Top 5450 with 25}

g Red gyttishale ¹³⁰⁰ 100

h. ~~Impure~~ limestone
holding cast of fusile
and also in the pure
limestone with fusine
shells. Gastropode brach-
iopode and lamellibranchs.

Red mud

4^{1/2} 6

15⁰⁰ 40

i. Impure limestone with
indurated gyphiferous
shale beneath.

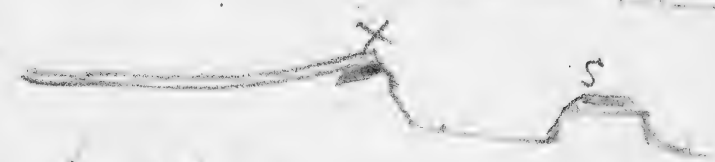
k. Red gyphiferous shale.

j. Impure limestone slab by
beneath (see pg 54) 2⁵ 13.

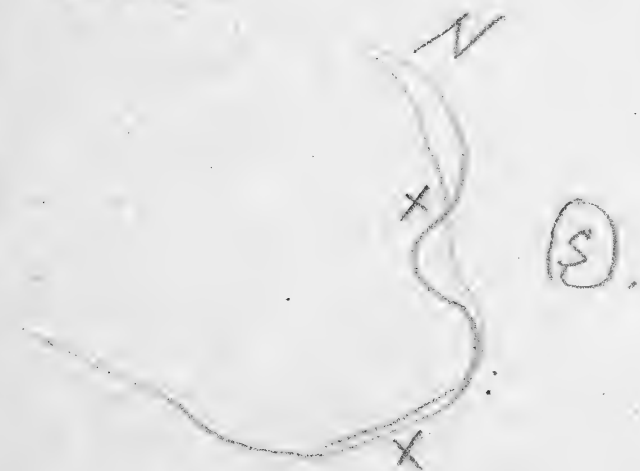
l. White mud 2 feet with
as below (rock) 70

The west side is composed of just
gyph. mud & thrust alternating.
Polish on Butte in west side

On the west side of the
reach, just before
reaching, the change of
the canon. The limestone
at the base of the glacial
lph. rises to the east and
south.



outlying butte is not affected
by the uplift. It is a local
area of disturbance. There
are other indications of
disturbance but too slight
to be determined as to dip
etc.



(1st
Cont)

h. ~~Impure~~ limestone
holding cast of fossils
and also in the pure
limestone well preserved
shells. Gastropods brachi-
opods and lamellibranchs.

Red mud

4th 6

15th 40

i. Impure limestone with
indurated gyphiferous
shale beneath.

k. Red gyphiferous shale.

j. Impure limestone slab
beneath (see pg 58) 25th 10.

l. White mud 2 feet with
or below (see pg 58) 70

On west side is composed of just
lygh mud + thrust alternating.
Solid on Butte in east side

The limestone capping the
low cliffs south of the Shinarump
conglomerate on the east side
of the Kanab wash, extends down
to the western margin of the
cliff indicating a fold and



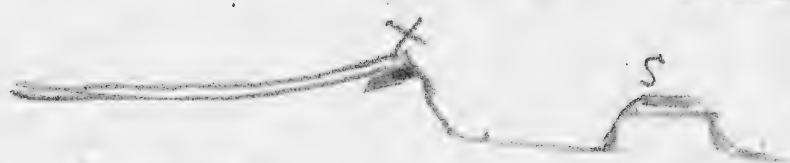
far as the Shinarump
conglomerate.

The general dip of the
undisturbed strata is

viewed from further east
south the stone is seen
to be the western end of a
synclinal anticlinal arch.
The entire structure is as
follows.

The dip is in fact due to the fact that the strata are not horizontal but are tilted.

On the west side of the
 Road wash just before
 reaching the opening of
 the Canon. The limestone
 at the base of the Phosph.
 Gp. rises to the east and
 south



outlying but they are not affected
 by the uplift. It is a local
 area of disturbance. There
 are other indications of
 disturbance but too slight
 to be determined as to dip
 etc



(S).

(1st
 Cont)

Shin G h.

disturbances

Health in broadest reference
cases of lower kind of Cancer.

the line separating the limestone bands.

East

as at the western margin of the cliff the dip is at the
strata then curve upward in a way partly at the
ground then down to the east forming a low
synclinal at C. as there is a gradual rise
to the east of C. followed to the north by the
general dip of all the strata. The western side

with for a long distance across the plain
thence the mouth of the canyon. A cross section
with north of a $x = 11$
showing a dome like rise at $x = 50$ S. in section.
The dip is 10° S. at $x = 50$ S. at the S.W.

The flat south of the plain
is broad and with the exception
of low outlying butte north
of the limestone the work
is a small river broad and
extends out to the canyon
you can see it where it
is stretches as far as the
line of sight. A few
mountain tops appearing
as far to the south. To the
north the river is the first
seen of the kind. The limestone
cliffs present a bold
face. The adobe & sandstone
having deep canons that add
to the varied surface by presenting
the side view of the limestone
cliff. Below the low cliff
of the limestone canyon, a small
capped with white of sandstone
as great line of ~~flat~~ ^{low} butte
with the line as a general
line of ~~cliff~~ ^{butte} resting on the land.

of page 54. rest on the modern surface of the red shale beneath. This is well shown in the outlying buttes on the east side of the wash south of the cliffs.



It varies in thickness from 10 to 30 feet. Contains many fossils. The upper portion is a sandstone holding large lamellibranch shells. 1/2 mile N.N.W. the limestone is not over 1 foot thick but a thick band of gypsum & arenaceous shales replace it. near the base a few sandy layers 2 to 6" thick hold lamellibranch shells.

59
The fossils occur in the upper limestone, sandstone, arenaceous shale with gypsum, laminated layers alternating of gypsum & sand & argillaceous shale. In the argillaceous limestone with fossils replaced by gypsum.

A section on the west side of the sand wash taken from the base of the Chianian Conglomerate.

The upper surface of the shale was eroded prior to the deposition of the overlying conglomerate as may be seen in most good exposures of the line of contact of the conglomerate and shaly sandstone.

The entire section was carefully measured with the exception of 75 feet of the lower red wash.

The conglomerate at the point where the section was taken is darker than usual and in fact is a very dark red color for a mile or more along the exposure at the point leads the upper in many places being a nearly pure white sandstone c.b. The pebbles are all agatized. No fossil wood was seen at this point.

100 ft.
Shaly sandstone, dark red, brown passing 20 feet from the summit into a massive sandstone. Pipple marks and cracks occur in the shaly portion. 135.

This is the c.b. of section (Shinarump).

21 Dark red arenaceous shale with veins of gypsum.

running thro' it, both horizontal and vertical. 135

36 c of section.

Gray gyttiferous mud, arenaceous, with bands of red color near the base 125

11 f of section.

Red arenaceous gyttiferous mud, Col. sandy shale more indurated near the summit 300
Measured 225 feet
estimated 75 by barometer
& dip.

5th 1. fine limestone holding fossils. Gastropods at this point 7

6 1 Red gyttiferous mud 15

7 Shaly infus. limestone varying from 2 to 3 feet

with arenaceous gypsiferous shale beneath. A few of the sandy layers increasing to 4 or 6 ft in thickness and holding fossils a banded red mud separates this from a somewhat similar shale and limestone beneath. An outlying butte on the east side the entire band is limestone the lower stratum being five feet in thickness. 25.

This last bed is of varying thickness as it rests on the uneven surface of the gypsiferous sandstone beneath which shows erosion.

Section continued on west side.

3 Red gypsiferous mud with arenaceous shale below. Low broken down summit 108

7 yellowish sandstone with red gypsiferous shale beneath 4 to 6 feet 37

10 Chocolate colored limestone containing cast of fossils and also a few faintly preserved specimens 15 to 25

11 Cream colored limestone with red fossils in upper portion. Small chert nodules 25

12 Cream colored shaly limestone 32

13 Limestone gray to yellow with much chert 31

14' Cherty limestone. Chert
is large, ^{round} masses, weather-
ing black.

Contains many
fossils. *Podoceras*, *Atthis*
etc.

35

Section of the canon wall. East
side at the first alkaline
springs.

• Cream limestone with red
fossils 11. of from our section.

Thence to the summit of the
cliff at this point to the massive
cherty limestone the strata
are much broken up by
irregular bedding, the
presence of sandstone and
the irregular distribution
of the chert.

150

Massive bedded cherty
limestone

200

A fault crosses N + S in the
section was discontinued.

2-1/2 10 1/2
76 1/2 13 1/2
147

Section of Cliff below Shinarump
Canyon.

1. Red fossil bed with
characteristic fossils caps
the cliff. Beneath this the
beds recognized to the north
as limestone with sandstone
beds are 4/5 arenaceous
rock with chert + some
limestone

200 feet

2. Massive cherty limestone
beds - 100 below cliff.

North 1 mile.

are indicated from sandstone
caps the cliff back from the
edge a short distance.

Cherty limestone with
large proportion of sand

100

3. Massive bedded cherty
limestone

250

Reddish grey

Base of red bed 4950
Top of red bed - 5725
875

Sandstone with Calceolaria
red in layers intercalated.
70

65

Top of sandstone 5975
Base of sandstone 5725
250
150
70
220
25
245
29

Top of chert bed 6100
6100 - 1225 = 4875

Top of chert bed 1225

125

Shaly limestone, yellow passing
to grey + white chert. 65.

Reddish grey fossils - 6200

57

Massive cherty limestone
Top 6425

225

+ Top chert bed 250
250

stone + containing fossils

Section
Canyon.

11
22

1. Red from
character
the cliff.
beds recog
as first
bed and are
rock with
limestone

2. Massive
beds.

South,
are marked
Cape the
edge as sh.
Cherty
large fra.

2. Massive
limestone

3 Cherty limestone thin
beds passing to calcareous
sandstone and yellow
sandstone. Holds
fossils in Calcepona
pentameri.

65

3 Gypsum bed with
alternation of friable
sandstone.

125

4 Cream colored limestone
passing to gray beds. a
arenaceous limestone and
to sandstone. (Cherty) 85

6 Sandstone with light
gray, with cast of fossils (Cherty)
Productus etc 140

c Light colored sand with
Calcepona Mayors. Then
into somewhat thin
layers than the mass
stone containing more

sandstone.

45 40

15

d.

Gray c.f. sandstone 30

15

5

245

Deep red pitted sand
with shaly friable
portion 255

Partially c.b. deep red
sd 20-30 feet passing
into evenly bedded ar-
stone 270

c Layer of gray sd followed
by somewhat massive
strata separated by little
shale (deep red) 280

Massed by barometer &
des Locke lens. each
game 775

6 & a was a c.b. gray sd
as an alk site Cliff 1 mi
west.

Section of massive c.b. sd below
4 miles below.

6. Massive bedded c.b. sd.

L.L.

315.

This is a variable bed in
color. Just after it makes
its appearance in the canon
the upper stratum is gray
to buff with deep red partings.
Then massive beds of a
purplish hue and again
reddish. Fine m. below
the purple predominates
at the summit and the gray
red & buff below. It is a
great mass with out any
regular divisions in color
or stratification. Near
the summit a stratum of
shaly limestone is inter-
calated at one locality
for a few hundred yards.
This is also repeated at

325

at the central portion &
even some c.b. strata are
somewhat calcareous.

As a whole the gray color
predominates in the summit
then buff followed by
purple and redish hues.

7

Alternating purple and
redish bedded sandstones.
Both colors may be present
in same band or layers.
A band of 20 feet may be
purple & further on redish.

Limestone occurs in nodules
& also in shaly partings
with friable sandstone.

The more massive beds vary
as to thickness. The c.b. and
color.

L. 4,

16

Bon 150.

8

Gray c.b. sd. upper surface
somewhat irregular.

92

80 Purple sd. partially c.b.
with shaly limestone
at the top.

25

3

Massive c.b. buff colored
sd.

58

L. 5.

155

Bon 150

9 Purple sandstone mar-
-m c.b.

10.

Note from 2. pg 66:

A careful measurement with
locks level gives of the massive
chert bed on the east side 2 mile
east of the section a huge 66
gave 265 feet for the massive
chert this included about 15
feet of the lower ^{and} cherty beds
which were included in the
beds below. The formation
gave 250 feet.

State on 3. pg 67.

On the upper part of
there are several beds.
strongly bituminous arenaceous
layers 2 to 6 in in thickness.

Small brachiopod shells occur
on west side.

At this point 1 mile below
Chimney on east side
the same beds. Top of massive
massive cherty is a level
with the west 150 above on

the west side. As seen with
locks level.

The limestone beneath the
gypsum bed is somewhat shaly
for a few feet but rapidly passes
down to the thicker cream-
colored magnesian limestone.
There is some sandstone on
the east side and the mass
as a whole is thicker by 80
feet than the same on the west
side.

74 Oct 22nd 71.

1/4 mile above mouth of Kanab
Canyon on the Colorado.

1 Massive indurated red
garnetiferous, 20

2 greenish micaceous ^{or} shale and
passing up into calciferous
sandrock and to mottled
gray limestone (trilobites) 30

3 greenish arenaceous or
micaceous shale (fossils) 115

4 gray limestone alternating with
micaceous shale
passing into mottled limestone
Passage beds to the mottled
limestone 70

5 Primordial trilobites, corals
& coralline markings.

Kanab ^{3 1/2} miles, westward
3 miles from the Colorado.

1. Calciferous sandrock at top and
base, buff sandstone between.
Thin weather black and all
is stained a reddish hue by
the wash from above. 35 feet

2. Gray and drab colored lime-
stone, rather predominating to
very hard, brittle, breaking
into angular fragments.
The gray limestone, banding
partly occurs at all levels
and there is much chert
weathering intermingled with the
limestone. The gray limestone
is in layers of varying
thickness 1/2 to a foot. Usually
contains many small flat
concretions. The upper part
of 50 feet to the first sandy
parting holds trilobite
beds and bryozoa.

Thin micaceous sand occurs
to the summit. ^{the lower}
band ~~of~~ is essentially a
repetition of the upper in
lithological character &
the same Trilobites heads
was observed in each.
The coralline matting is
seen in the lower half,
chiefly. Also seen to the
summit.

This band is a portion
of the Luto group and
carries the Pennsylvanian
up to the sandstone.

It is broken up into small
bands by shaly partings,
usually arenaceous, and is
again subdivided into
thinning strata and bedded
strata.

Upper bed	85.	
Center " "	295	
Lower " "	70	450

3 Greenish micaceous shale
arenaceous shale and a
few layers of gray sand-
stone, passing up into
arenaceous limestone layers
of preceding 100.

Add section 1 1/2 mile up the
Colorado. See pg 74.

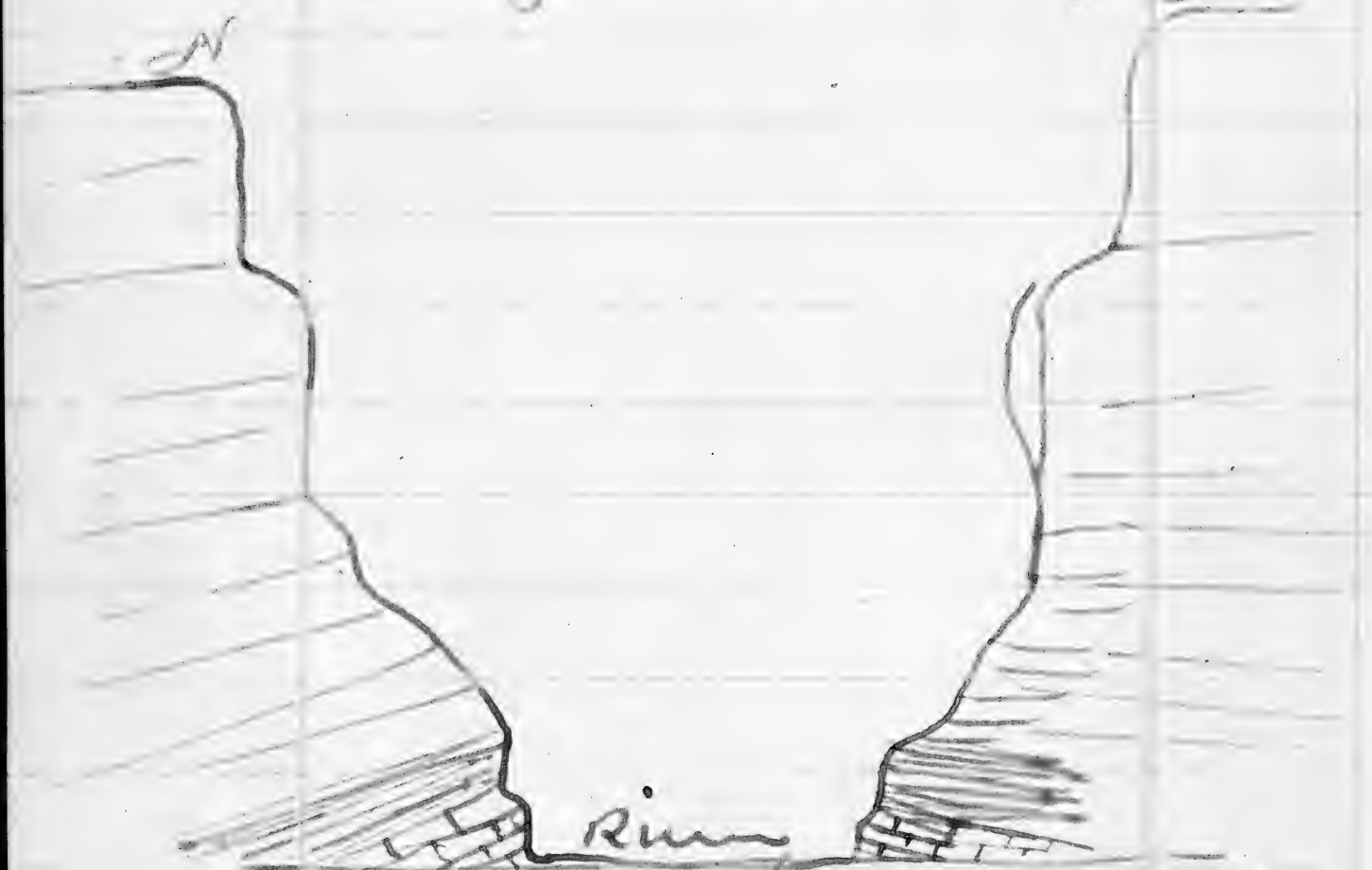
Found Trilobitic remains
Lingula and Hyolithes
in 3 also in base of (2.)

Station at mouth of Canon. Top of
lower division of limestone
at 1.50 + down the Colorado
S. W. 2 1/2

The calcareous
the heavy sandstone at
the base of the Luto group
runs to the N.E. going up the
river above the mouth of the
great Canon. About 1/2 mile
above it is 50 feet above

the water and ^{just below} at the mouth
of the Kanab Canon it passes
beneath the water lying.

A half mile above the strata
on the north side dips 15° to
the N.W. & on the south
side of the river 12° to 15° to
the S.E. The higher strata
(limestones) do not appear to
partake of this strong dip.



Local pushing out of
strata at base of Canon
walls

Partial section on the east
side of the canon about 5 miles
from the Colorado. Oct 27"

1. Gray (light) limestone, resting
beneath banded cherty lime-
stone. A careful search
did not show any fossil
remains that could be
identified as such. 85

2. ~~Thin~~ limestone, friable, stained
purple, with a few thin
stone layers in the central
portion 35

3. This band of sandstone
forms a shelf which
extends all along the
cliffs on each side of the
Canon & also the Colorado
Canon above it over
the archer cliff.

3. ~~Thin~~ limestone, resting
as in 1. 70

4. ~~Impure limestone, anemic~~
in places, with masses of
caliche. Gray mottled
with purple. ~~Uniform~~ gray
on weather surfaces.

90 feet from the summit
the gray limestone again
predominates and contains
down 90 feet + becomes
more anemic than
succeeding 25 feet. 185

5. Gray and 80
~~Impure limestone passing~~
into buff sandstone with
layers of ~~limestone~~ layers 50

Below limestone (2)
pg 75.

The mottled limestone
occurs near the base of &
the purple mottling's weather-
ing out in relief.

the mottled limestone
with internal
dark layers and collected
fossils from the same. They
have a subcarboniferous
aspect.

146

The chert is in layers
of nodules + irregular con-
cretions coincident with
the bedding + forms about 1/4
of the mass. Fossils occur
in abundance near the
central to upper part. Below
none were seen,
Spirifer, Orthis, Chonetes, Modiola
etc with many species of
bryozoans occur.

Thickness of bed 145.

These beds beneath the massive gray limestone beneath the chert are irregular

Oct 31 1877.

In coming up the canon noticed several illustrations of the erosion of the limestone beds & the deposition of sandstone etc. fossils to the massive gray limestone. Also local corals of the upper portion of the Silurian strata.

Remained the chert bed then miles above camp a thin 100 feet + 75 feet by Locke level. = 150 feet. There are not as many fossils at this point as below & the proportion of limestone is less than at previous section. The chert is light colored weathering black.

Going to the massive limestone above the chert bed near where the Sanokanab springs issue Arizona

The upper portion 250 feet was measured by the Locke level. The remaining portion with the line & a short distance with the level.

1 Shaly ^{gray} limestone with small chert and intercalated arenaceous layers 255

2 Massive light gray limestone with some evenly bedded cherty layers near the summit. also at 200 feet below a bed of cherty layers intercalated with the limestone. 487.

Fossils were found at various horizons but none abundantly near the summit. A species

of *Syringopora* occurs in great abundance in the form of casts of the stems etc. near the base.

Another section of this bed was taken two miles further up the canon, all but 75 feet (measured by hand) being taken by Jocko level 477 feet was obtained

The upper layer of the limestone. (The two upper bands) are very unevenly bedded forming undulations

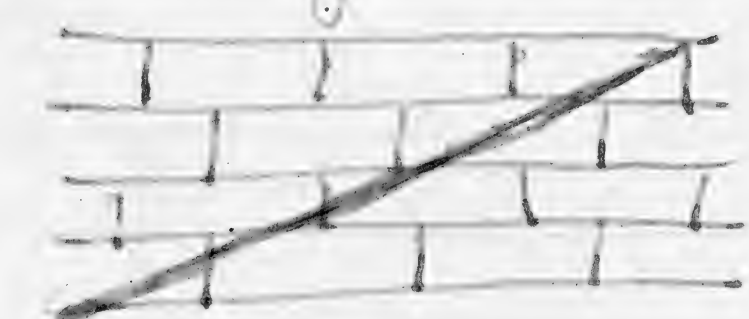


this irregularity is taken away by the limestone

so that at the base of the purple sandstone the same horizon is restored.

The massive light gray limestone is usually divided in ~~four~~ six massive bands which frequently break into small thinning bands. The ~~upper~~ cherty bed was not penetrating after being about 1/2 the limestone uniform.

Recess oblique to the stratification occurs in the limestones of the Carboniferous



Portail's section. Head of Canon
in same limestone. Lower
Kanab Canon, Arizona.

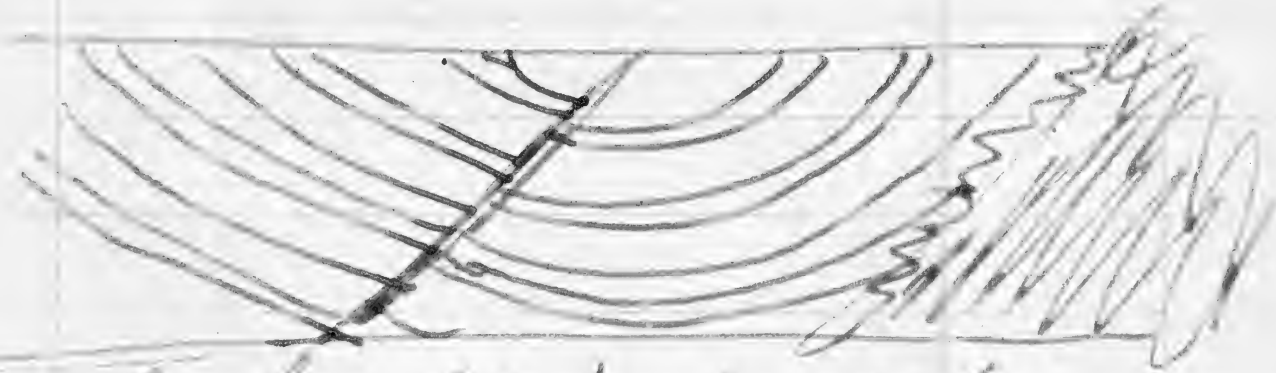
Gray limestone with white
chert passing up to shaly
limestone with pink or
red chert and then
becoming more arenaceous
with thin bands of
pink chert & shaly lime-
stone. 300 feet.

The boundary both above and
below of this band is very
changeable. Below the upper
surface of the limestone will
cause variations of from 0 to 50
feet & above the pink chert
may run up into the sandstone
much further in some places
than others. The purple
sandstone above was 40
feet in thickness where

the section was taken.

The first bed is a ^{bed of} passage
from the limestone to the
sandstone.

The highest inclination
of the laminated layers
of the crossbedded sand-
stone that was observed
is 27° . The highest general
average is about 20° to 23° .



Local faulting in C. b. ss
white band in
Chiffs.

88

89

145

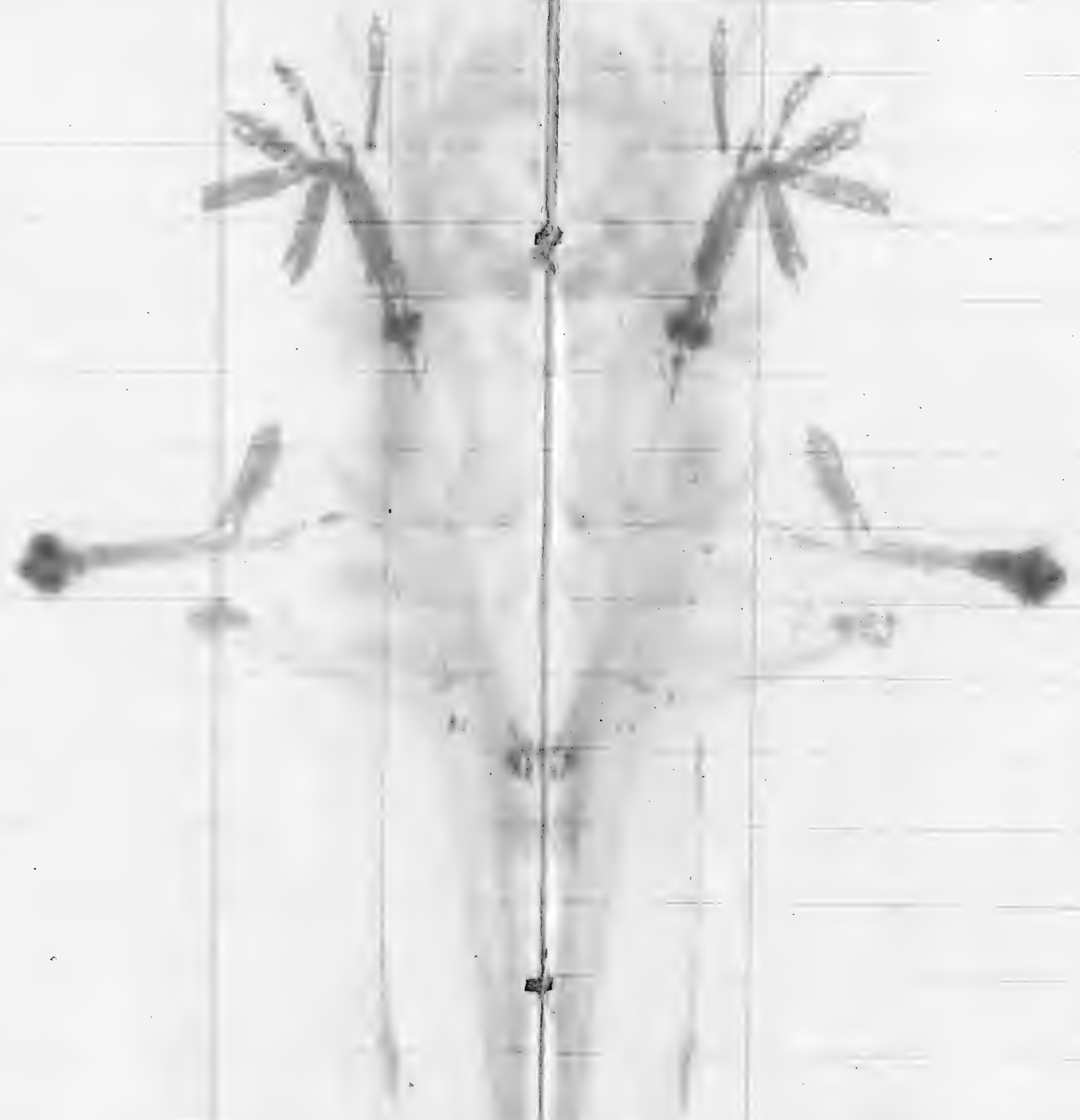


147



148

149





RU 7004 / Walcott
Arizona Grand Canyon
Field Notes 1879
found between pp 148-9

1200
Faults.

Pg 4. South of the Conger
head creek. Pg

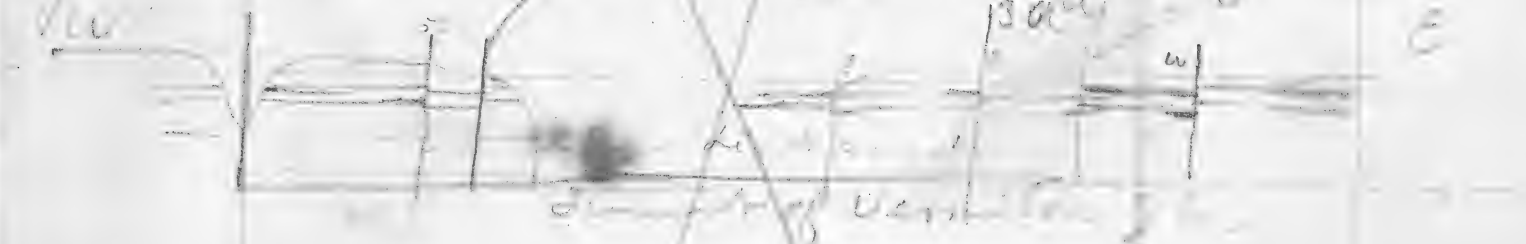
Pg 11. Fault 100' E of head of
Cedar Creek.

At its mouth of the Konger
creek at the head of the
a well known on the west
side crossing the stream
near to the south end of
the west side of the
congrer head of creek
out to form a line
about the village of head.

Line of fault S.E. x N.W. with a
small thrust to the S.E. of 60 ft.
the conglomerate layer is at
the summit of each ridge
about 1/2 mile apart.
The fault is a very deep
thrust the rock is
light gray cross-bedded
sandstone with heavy beds
of sandstone on the north side

of the sandstone is a
very S.E. x N.W. fault
which extends to the north of
100 feet.

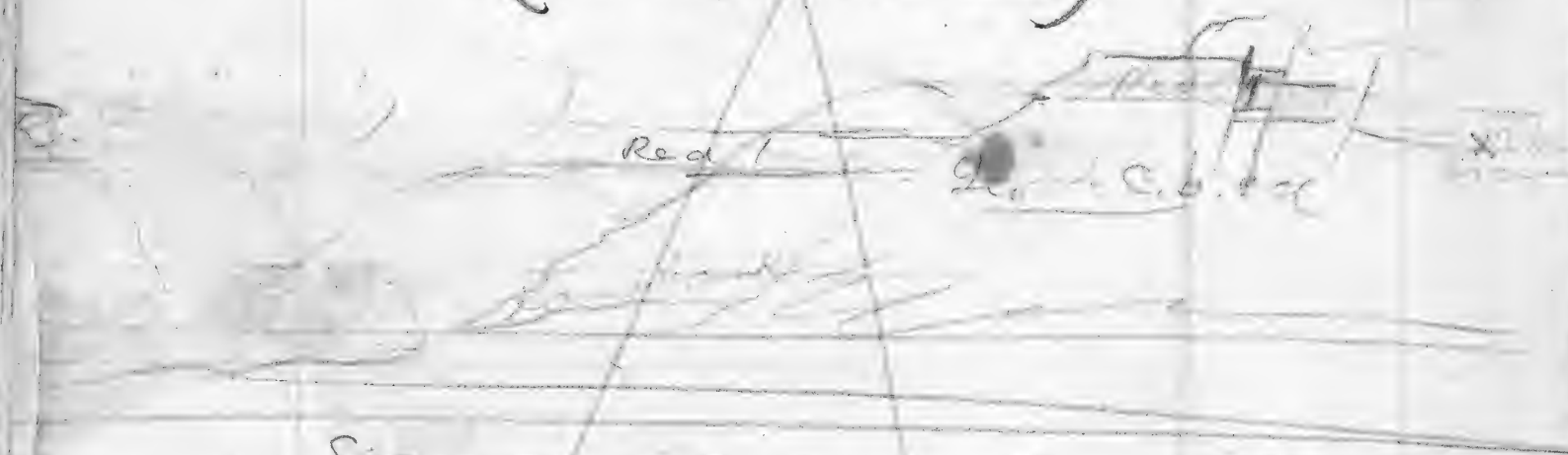
Crossing the head of Conger
3 miles above head of the
two ravines, one on the E. & W.
across the head of the
top of the sandstone is
following.



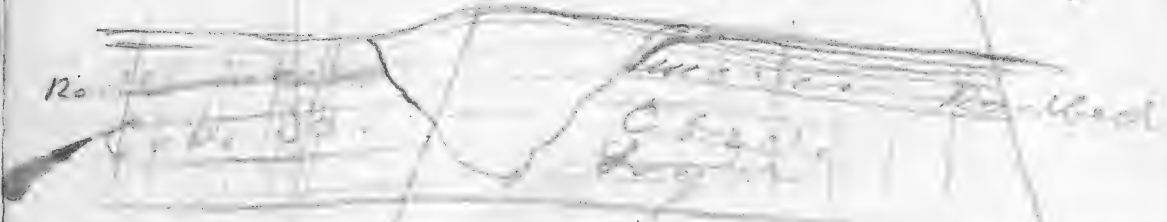
The general reference to
this fault is that there is a
slight dip to the west (E. & W.) in
the vicinity of the fault. There are
many small cracks running
upright from the summit of the
hill down to the base. The
plane of the fault is at a
S.E. x N.W. at a distance

a section from the S. side of
the ravine on the S. side
up the hillside that the
side is elevated 50
feet above the water table. The
red sandstone is 50
at the same horizon (10 miles)

(Rexamine)



(Rexamine)



The ravine of which the
reach to long valley from
branches to the west
hills north. A few
it is about 1000

The canon with a
+ 3.5: line. with a depth of
50 feet to the higher of the
ravine divides the ~~the~~
canyon of the road to the Mark
passes the apparently along
the line of a slight fault.
higher up there small
occur.



The alluvial material
left of the ravine is ice.
The ravine is small.
The ravine just before
about 1000 in the
(2) lies against a
4 - partially cut off by a
low rocky point covering the
ravine. No (3) near the
ravine is a small
the alluvial material
the ravine.

154

Latest day before the
next turn of the round (?)

155

On the summit of the lift
2^{mi} S.W. of Pile's old place
Kanak (Upper) valley 8800 feet
there is a cap of basaltic lava
300 feet thick. On the west
the top of the Pink Cliff limestone
same division is at the same
level as the top of the lava.
The strata dip North $2\frac{1}{2}^{\circ}$ which
is not apparent E & W dip. It is on
the west side of the fault running
from the Pink Cliff uplift west of the
divide at the North end of the
upper Kanak valley. On the
east the Cretaceous strata
of the ~~limestone~~ coal division
cross from the eastern fault
over the Kanak & Kanak valleys
up to the large canon that
leads up to the lava bed.
The strata preserve uniform
dip slightly rising to the west
& south until it passes beneath
the lava. There is no.

8825
8575
250

1-621

evidence of a monoclinical fold. To the north the tertiary strata rise from the N.W. No evidence of the presence was seen on the land capped hill.

On the next Knoll south of the buff sandstone outcrops with a dip of 100° N.W. 8825. No means of determining the position of the sandstone existed beyond the probability that it belonged to the upper division of the Cretaceous. There must be a fault east between this point & the Kanab valley lower position.

a little south and 250 feet lower the Astrea bed occurs in position dipping N.W. 100° .

Dip $75^{\circ} \times 250 = 320$ feet

157

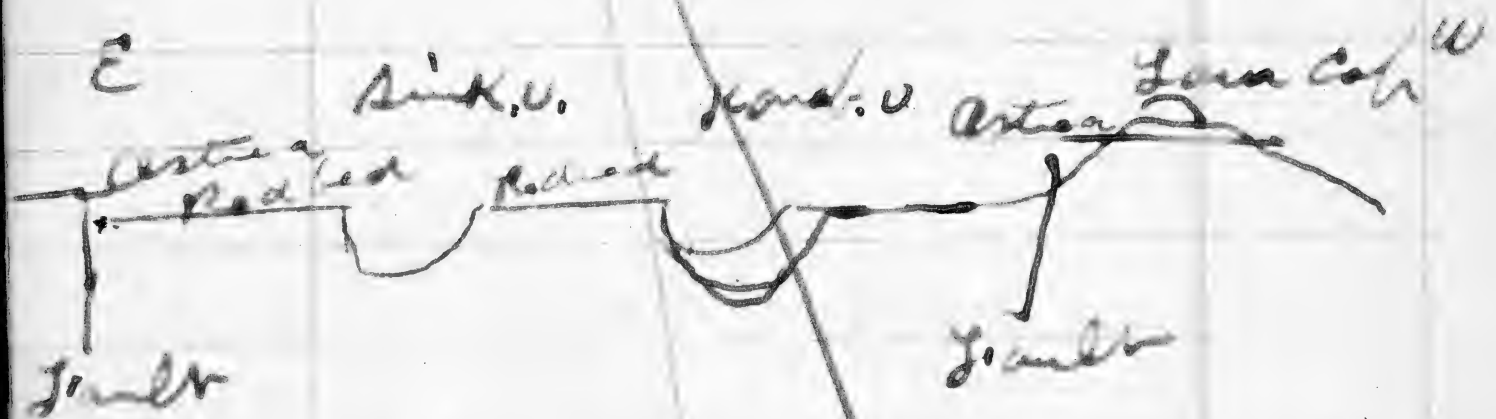
Astrea bed beneath sandstone on top of hill. This is a continuation of the dip & strata measured $\frac{1}{2}$ mi N. above the Lenticular bed dipping 100° N.W.

The Astrea bed again occurs to the S.W. at a level of 75⁸⁹⁰⁰ feet below the other outcrop & dipping N.W. exact dip could not be determined.

Also occurs again westward N.W. slope at 8450 slope is S.E. & again ⁸³⁵⁰ on high hill N of Upper Volcano in valley below Pilsen. The dip here is 300° N.W. The rock is filled with the Astrea shells.

Quantities of large fragments of the Astrea bed and the sandstone underlying it occur at different levels. In 300 feet below on the

hill side towards the Catalans.



The Cretaceous strata dip to the N.E., rising to the S.W. The base of the coal series above the gypsum monks is 7650.

Thickness to Artesia bed, 1230.
8880

From Artesia bed 8350
530.

530 = fault a lowest estimate, but as the Artesia bed + associated strata dip N.W. 10° & there is evidently an uplift towards the volcano the south of the strata west of the fault. From the Artesia bed occurring at

different levels in the E + W line there are several parallel faults across the west side of the valley to the north towards the Pink Cliff uplift. The strata on the other side of the long valley canon are separated by a still greater downthrow to the west, in fact I would regard the Cretaceous strata as having been elevated.

The lava flow occurring on top of the hill points to the cause of the disturbance especially as the faults go on a line with the volcano below.

The fault or faults crossing over from the Severn plain on the west side of the bank runs well above white cliff & apparently miles to go south thro' the Long Valley Canon.

The eastern, of the Canyon on the divide separates the Cretaceous of the valley from the Tertiary and Cretaceous N.W. uplifts in the western hills over to the Long Valley canyon. No evidence of a fault was observed in the Hard Canyon white cliffs or in the canyon east to the 2d opening in the Johnson canyon. To the west no observations were taken in the White Cliffs or the Long Valley canyon cut off faults in that direction.

Note. From the base of the gray sandstone (sometimes conglomerate) beneath the Pix. Cliff limestone to the arenaceous clays beneath the massive sandstone next below the red bed appear to be a great natural growth characterized by the predominance of sandstones + clays, parting in great minorly as combined with the red.

2. The next division consisting of clays + ~~masses~~ arenaceous soft easily disintegrating shales extend down to the red bed or shale above the sandstones containing ~~any~~ fossils. This division forming low rounded hills usually extending southward to the next bench of hard red.

162.

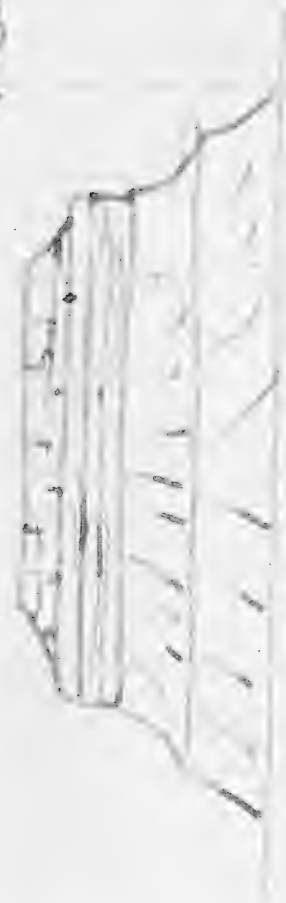
3. The ~~gast~~ sandstone ~~is~~
gradually giving way
to bands of shale & bituminous
clays with coal extending
down to gypsiferous
strata above massive

4. The gypsiferous clays
& carbonaceous peat
to the massive limestone

massive to white
Cliff sandstone.



Rust rock following



163.



Rust, south of limestone cliff.
12. 1/2 m. S.E. of 10 m. of
interfingering with the rust. ~~massive~~ ~~massive~~ ~~massive~~
massive of the rust.

1541

Entrance strata west of the
towers uplift west side of
the valley (upper).

Cream Colored Linen	50¢
White Linen	25¢

2 Pint (dark)

3 Cream colored sd. 50

11. Pine colored / hust - 100 "

7 Pink (reddish) / dust -

~~150~~ 150

succeeding well south
 capped with buff sd.
 such as occurs beneath
 the Pink Cliffs; a strong
 iron staining of
 occurs about 100 feet
 down.

300-

Just to the S.W. of this hill
there is a hill of white
residual limestone
similar to the limestone
found on the red clay land

165, 166, 167...

A small shell was found
in the sandstone. No
fossils yet observed in
the limestone. —
~~whitish limestone.~~

[illegible]

Upper Kanab. Head of Valley.

The Pink Cliff run N. & S. as on map, the cretaceous running in nearly a parallel line for along distance just west N. & S. of the divide. Coming into pink valley on the South. The cretaceous is 1 mile or more in width across the divide is replaced by the redish conglomerate which in turn goes way to the Pink Cliff uplift to the west of the trail over the divide.

The cretaceous rock runs round south of the conglomerate & Pink Cliff uplift

N. of the divide. West of the trail the beds are the same apparently as west of Kanab valley. (Upper) & may be seen


extending 4 miles north of a mile in the Kanab Valley. Rocks South + W of uplift (P.C.) have not yet examined
Sep. 8. 8" 1879.

South of the Pink Cliff uplift the sandstones beneath rise at an angle of 28° for a mile the dip is N. W.

Elevation of Pink Cliff uplift 8925 feet. Strata beneath retain the same dip 28° N. W. and pass down through the Lenticular bed beneath the Pink Cliffs to the upper portion of the Cretaceous. The distance to the lowest outcrop in the valley to the S is $1\frac{1}{2}$ miles. Elevation -

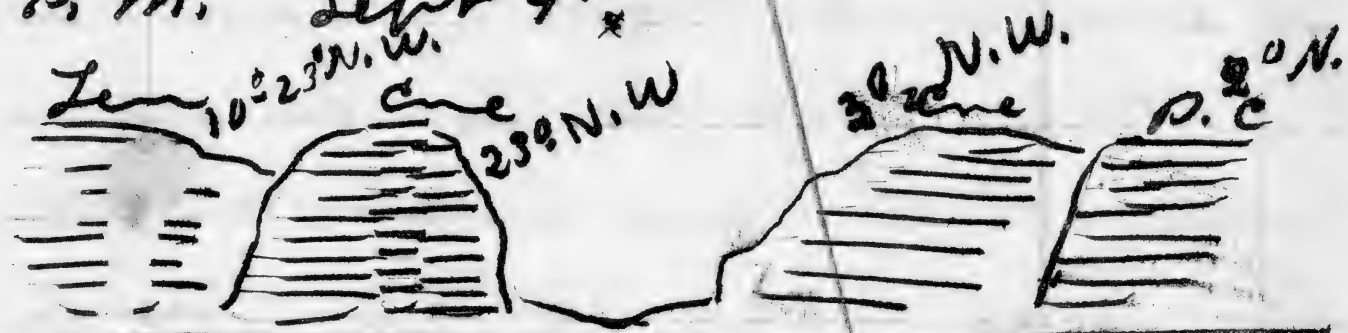
On the west side of this uplift Lenticular limestone may be seen meeting against the sandstone, inclined

at the point 17 of contact at the same angle but a short distance back it is reduced to 10° ^{west 230 N.W.} & soon assumes the horizontal position E. & W. with a slight dip to the north.

 Whether a fault exists to the west was not determined at date of writing Sept 9th 1879.

Elevation of Lantry hill, west of Anetaceous uplift ~~2500~~ ³⁵⁰⁰.

P. S. M. Sept 9th



E & W section south of P.C.
Uplift. $1\frac{1}{2}$ miles.

171. A fault or synclinal is shown by sketches 1 & 2. ~~10 1/2 miles west of Lantry~~ The strata of the Lantry ridge dip 25° N.W. & the strata on the hills west 1 mile dip 5° N.E. The hills west are composed of limestone capped with sandstone & some sections are covered with a bluffer to the center. The fault passes down the valley west of the ridge & appears to be the westward low down center of the highest part of the valley side.

172

Upper Kanab valley, West side
8250. B. at 2.0 P.M. Sept 8. 79.

The Pink Cliffs facing W &
S.W. show a slight dip to
the N about 20°. The Cretaceous
strata to the west have the
same dip & the Astoria bed
16.00 feet from the summit
of the series of Cretaceous
beds is a marked feature
of the landscape, rising as
it does 88050 feet above tide
with the high Pink Cliff back
feet above tide.

On the left the beds of the
Pink Cliff of the west side
of the valley dip N. at an
angle of 28° rising against
the Cretaceous rocks.

P.C.
Cretaceous

To the 173 east the
strata have the uniform
dip to the north and consist
of higher beds (apparently
still cannot tell). Color
white, capped with redish
brown. The Glendale fault
may lift the Pink Cliff or
depress the white beds.
The redish beds are capped
with white limestone 4
miles west of Kanab
valley (Upper). The summit
of the Pink Cliff uplift on the
west side is 8925. 2.30 P.M.
Sept 8. 79. A little west
of the road over the dam
leading down to Kanab
valley there is a mass
of redish colored conglomerate
about 75 feet is exposed
above the talus. It is
the matrix is a redish hard
fine sand or margillaceous
material & has embedded

in it fragments of pink
limestone & sandstone brecciated
also small pebbles of quartz.
The pink rock prevailing.
The bed would appear to
be made from the destruc-
tion of the pink cliffs
limestones & sd.

Barometer 8800. 4.0 P.M.
Sept. 8. " 1879. Dip 52 N.

Cretaceous hill E of last
9100. 4.30 P.M.

See sketch of valley &
divide from this point.

Strain of redish conglomerate
& pebbles of same extent
175 feet higher up the
hill than the summit
given above viz. 8800.

Altitude best 8275 on line
of sect south of Cor 9.
Sept 8. 1879.

Ripple marks & other evidence
of tidal formation in limestone.

Ripple marked slate also occurs at
various ranges with carboniferous
gr. Devonian & white cliffs
much cracks also occur throughout
the ~~in the~~ argillaceous shales.

The numerous beds of crossbedded
sandstone also indicate rapid
currents & deposition of sediments
in the water such a strong
current bed would produce
a ~~marked~~ ^{marked} ripple.

The ~~marked~~ ^{marked} ripple in the
sandstone is typically produced
in all directions by the action
of waves from the sea. The grain
filling cracks in the sandstone
may be seen in the rock. The
marked ripple is also seen in the
limestone. The marked ripple is
also seen in the sandstone.

The sandstones of the lower portion of the Crossbedded ss of the W.C. Fk., are usually very fossil when exposed to the weather at an angle to the outcrop. The general appearance of the beds is such that it appears that the thin layers were laid down by a gentle current, such as a daily tidal current and then heavily strong currents, tidal or storm, level off the strata and formed a smooth floor upon which it deposited a layer of sand which in turn was again buried beneath the shifting sands which in turn were level off again etc., etc.



* Present bed of springs + stream of Kanab creek. Vermilion Cliff. a deposit of sand etc., evenly bedded + showing source of material in the red + light colored layers caused by the wash from the red and white beds above. Height of terrace 35. (b) A second terrace of sand extending to the west of (c) the red sandrock has a grayish color probably owing to the upper terrace having rested against it. The lower terrace can be traced down the cañon for two miles or more evidence of the upper terrace (b) is seen but a short distance.

at the summit of the white cliff on the west side of the Kanab Canon looking east it appears that the white cliff (summit) is elevated a or 100 feet above the western edge of the same canon. This must be owing to the fault which crosses from the upper Kanab Canon S.E. to the Johnson Canon on Bl. of Clarkston. The white cliff all has a slight dip S.E. from the Kanab Canon. As from the long valley fault to the Johnson Canon.

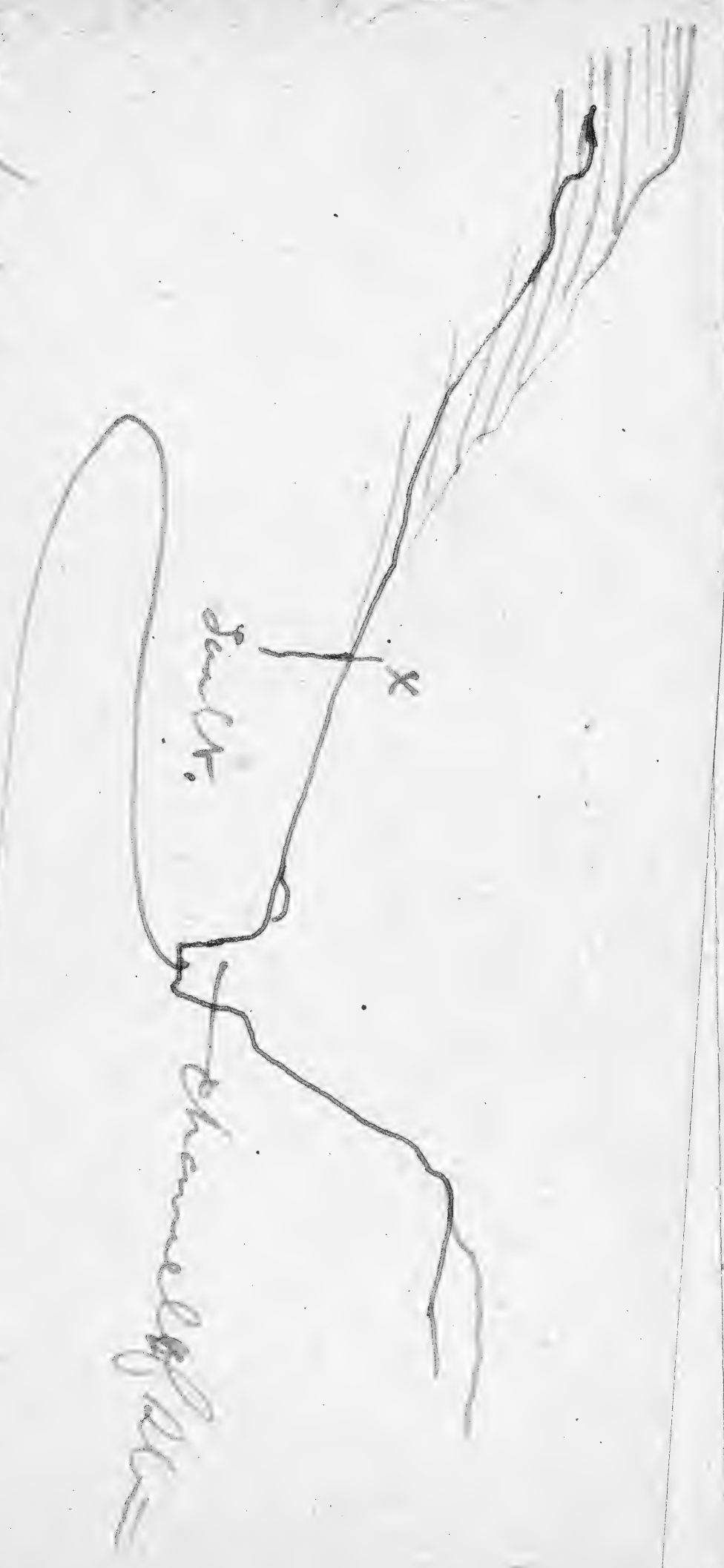
No evidence of a fault was obtained at the mouth of the Kanab Canon in the white cliff.

The lava flowing from the Volcan at the head of the Canon in the white cliff

passes down the old Canon of the Kanab valley entering the present road Canon & flowing for a long distance on the east side. Since the lava flow the Canon has been worn much larger on the west side & the lava stands a black wall on the eastern side covering everything like a great snake down the Canon following the old drainage channel of the stream into the Canon. At the head of the lava stream the volcano divided the old valley into two water sheds one passing down this the old drainage line, on the west cutting thro' the lava bed to enter the main Canon. The other, passing down a channel down which the present road runs.

over 100 ft North

1) a

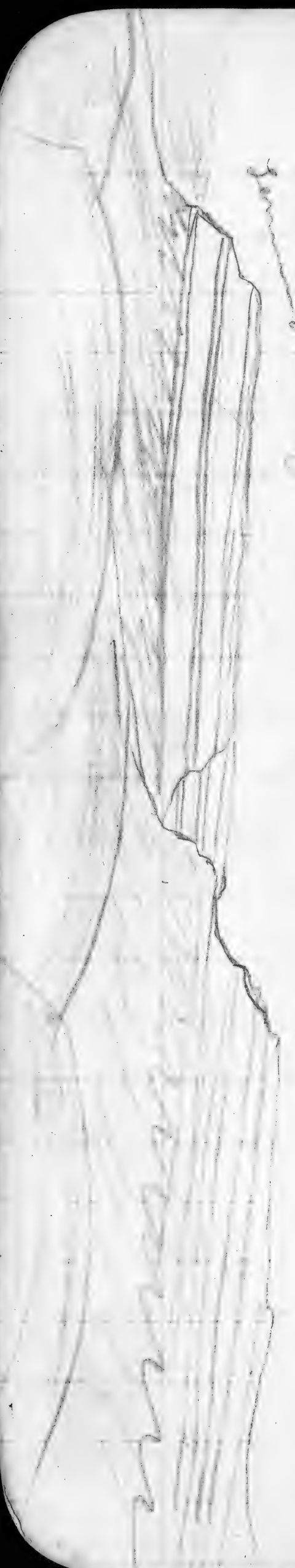


a fault occurred at x. It may be seen above
the main ~~channel~~ ~~of the~~
does not show as well as compared with the north side 1911

white cliffs

178

some of the old wall work



same as N. North

(1)

Quartzite

main valley

40 N.

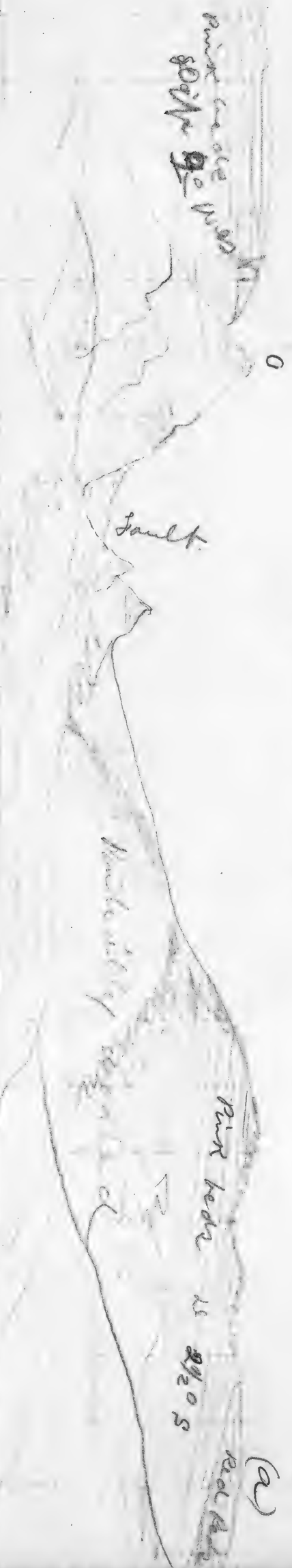
Aug 8th 1921

(2)

3d Camp

N

S

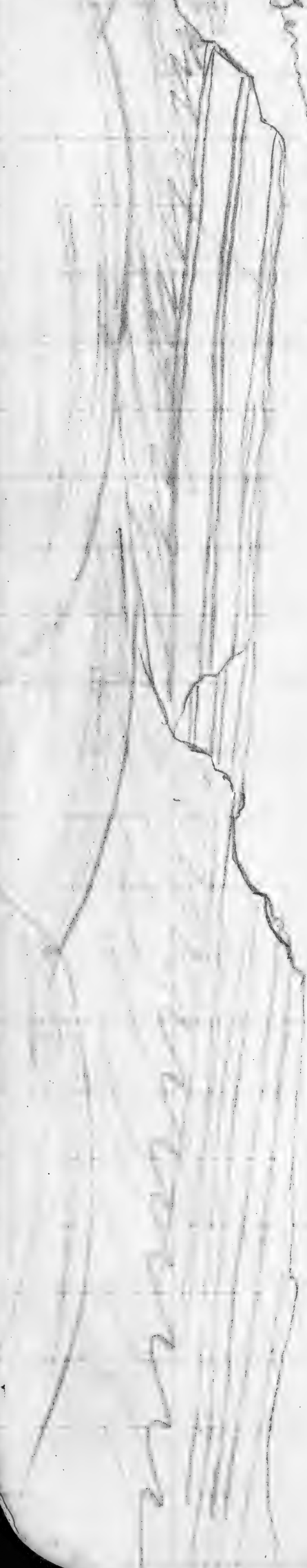


Seen from 2 miles to the south of (1) the redish beds at (a) well shown & a granite the wooded pink Reddy the pink beds have beneath lower beds 15, the north. South the hills are wooded & the bedding does not show as well. Aug 8th 1921

white duffs

178

Some of same with wood



Opposite Hillsdale the
P. C. strata dip 40 west
on the north side of
the C & W canon.

See page 179. of Nat
Park.



1. Dark pink & resting on eroded
surface of 2.

2. Pink cliff near dip 30 N.E.

3. " " " 20 W-40 N. to
pass beneath lower beds.

Taken 6 miles south of Hillsdale
from W side of main rim.
Nov 14th 79.

1890

1890

1890

1890

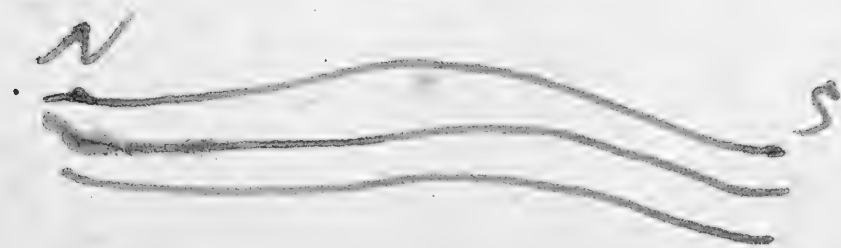
1890

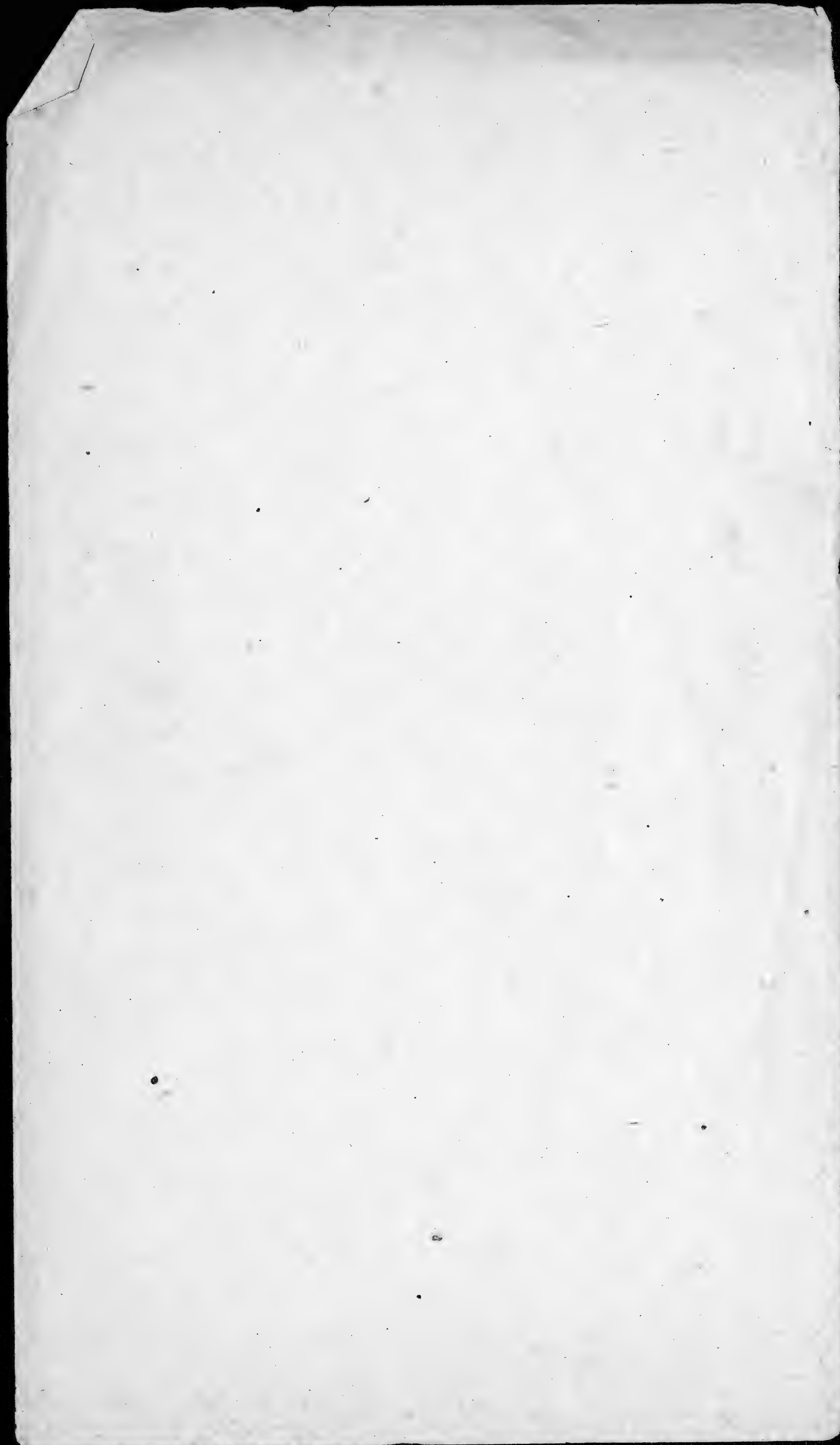
1890

1890

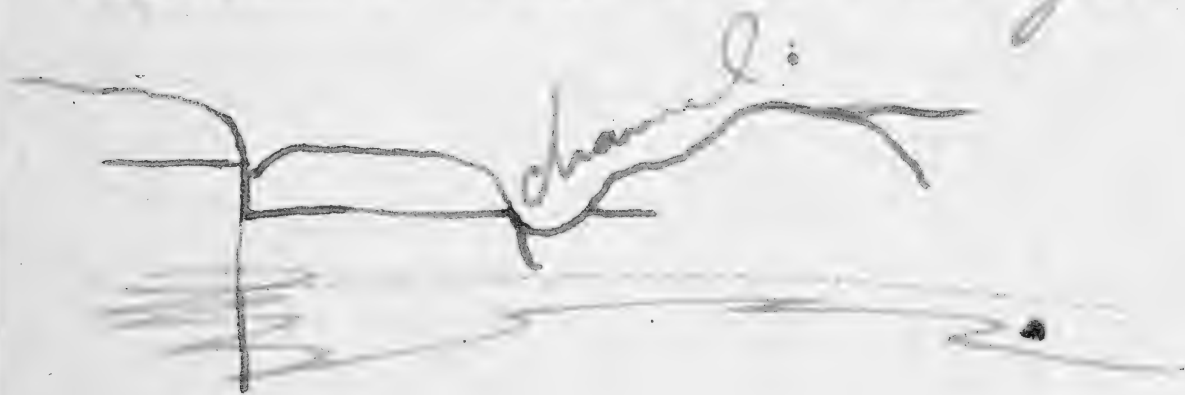
Summit of Cherty Lush
Kimb Canyon. Utah. Oct 6th 29
(1)

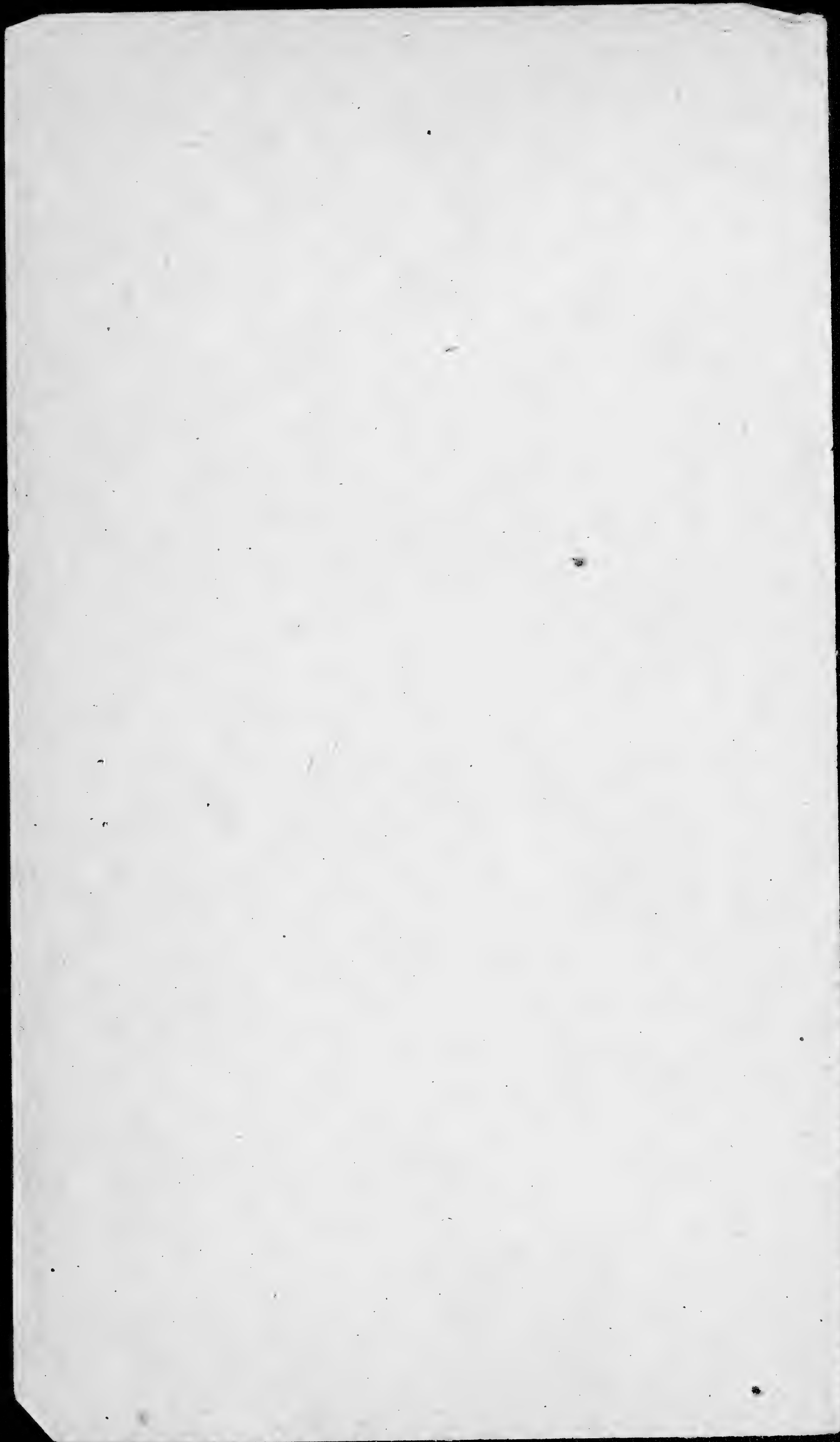
Viewed from the summit
of the cliff west side
300 feet above the canon
bed. The strata of the
upper 150 feet are seen
to be mainly bedded
and also curved more
or less in beds not in
relation to any definite
direction but as tho' the
bed upon which they
were deposited was uneven.
are mainly south.





When the red bed makes
its appearance above and
below the left hand or
east canon going down
the fault is very plainly
seen. The dam then is to
the west and is over 100
feet. The strata bend towards
the from the east and rise
towards the west slightly.

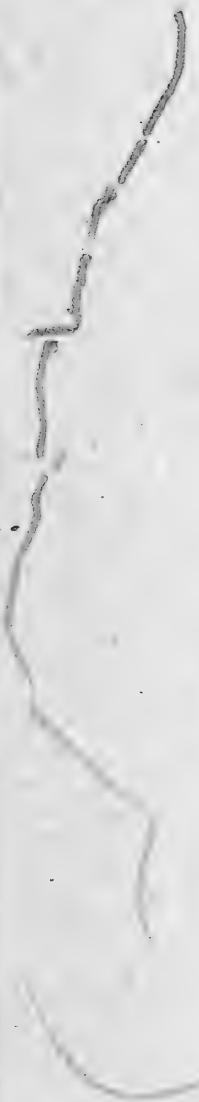




Point of channel of the

a part of the river at X. It may be an old

the river

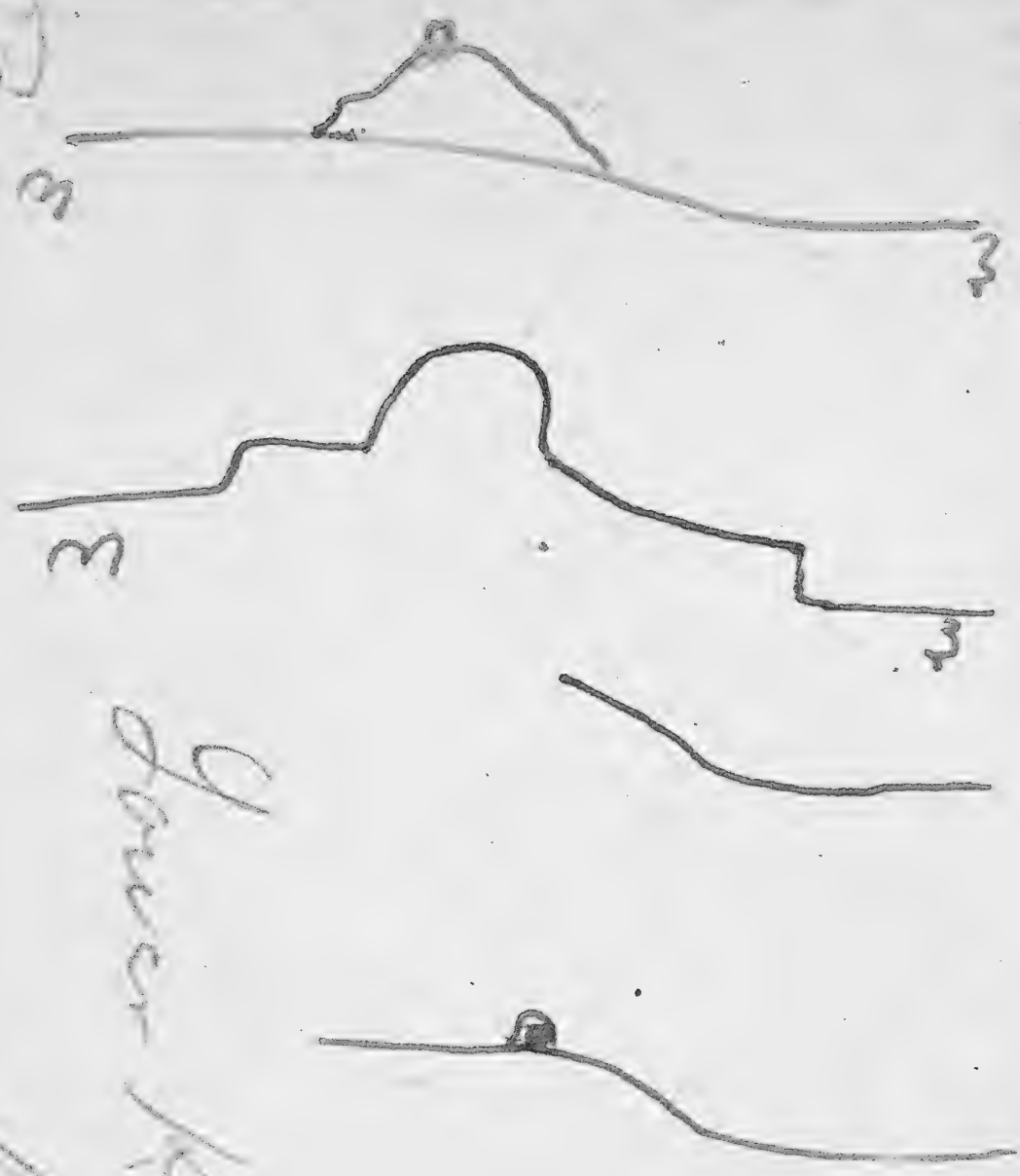


Section across canyon
 with calcareous thin ss.
 West side, Redford Red. sp. 25.
 East side same bed.
 5750
 125

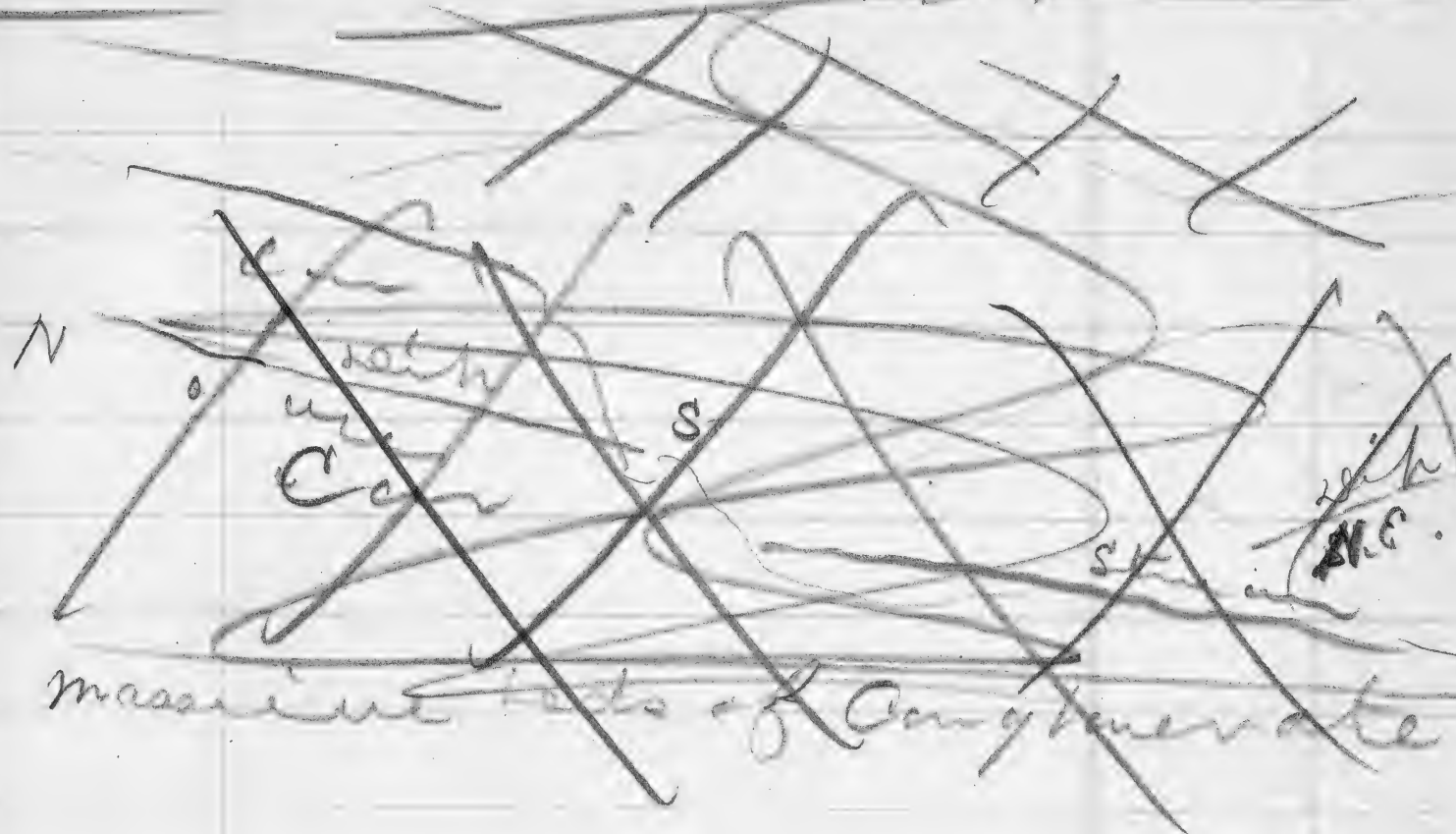
Oct 11, 1979

Lower Nevada Canyon

fault



~~Ironworks Pass Aug 7th 79~~



stream

1st Camp

Tremonts pass. Aug 6/79

South side, 5 miles up pass from
the west entrance.

Base of section light colored
thick bedded sandstone (2)
with layers of bedded (?)
conglomerate intercalated,
about 60 feet.

The conglomerate is composed
of ^{small} broken, angular fragments
of volcanic rock and larger
rounded stones & some boulders
of from 2 to 3 feet in diameter.

The sandstone matrix is of
medium hardness & when
the broken stones are removed
gives the appearance of
a bed of ~~matrix~~ substone
work.

Near the summit the
sandstone is more of a yellow-
ish color & is immediately
overlain by a thick deposit
of volcanic rock (1) 30
feet thick. This is evidently

an intercalated bed.
The ~~entirely~~ ^{sandstone} conglomerate
has the appearance of
having been deposited
rapidly. The sandstone
being deposited and
mingled with the products
of volcanic eruptions,
& the broken & rounded
fragments of beds of lava
etc. Dip of ^{bedded} sandstone about
15° N. Above the ~~same~~
bedded sandstone layers there
is 4-500 feet of coarse con-
cretionary material extending
down the pass for several
miles, if the dip is retained
& the strike. A view from
the opposite hill (West)
gives the following
section.

Conglomerate

(B) Cambrian sandstone
Conglomerate, quartz

(C) Cong
E. b. sand
Cong

a volcanic neck in the

Conglomerate

(C)

Embroidered
dip. W. 10°

Cong

E. b. sand

Cong

Cong

E. b. sand

Embroidered

(D) NE

3

N

C

Pass

(D)

(13)

(C)

(29)

3

at Pahranaagat, Lincoln Co. Nevada
Dr Newberry stated that ~~thousands~~
well preserved silurian fossils occur.
Primordial. South of Ogden and
also 50 miles south of Fish Spring.

Wahsatch range + Sierra Nevada elevated
at the close of the Jurassio. ^{Whelan pg 27.} &
slight changes as late as the recent
Tertiary

Whelan Rept.
Sect III = Upper Kanab section.
" IV = " " "
" VI = Lower " " "

Sect pg 270 = Kanab Sect?

Received from Mr Bodfish
1. Clinometer.
1. Lock's level.
1. Tape line - 50 feet.

57
 19
 38
 23 13 38
 158 322
 Sink valley 28
 Road by Mr. Selous 140
 185
 50
 235
 40
 6000
 5775
 225
 13
 5
 65

Aneroid.
 Base of hill 5925

Aug 19. Base of Barometer station
 5525 feet. 8 A.M. 4 P.M. on summit
 627 of hill 6325
 5525
 75
 250
 35
 85
 45
 41.5

Aug 23. And at summit of
 white cap of hill 5925
 of Aug 19 - 2505 - 5775 - 10 A.M.
 at point of Van Blon 5955 - 10:30 - 2
 " of red shale 6450 - 11:30 - 3
 top of hill
 at 2 P.M. 5840 2 P.M.

Mission San Luis 41x
 Chert bed 150x

Record of specimens Vermilion Cliffs.

Conglomerate.

180
 340
 510
 35
 90
 6
 30
 64.5 13
 587 73
 23
 19
 95
 105

Annularia (Shinarump).

To fish bed from top - 250
 Fish beds & shonks 100
 To top of Shinarump 210
 Shinarump marls 540
 etc 350
 Estimate to top of conglomerate 350

8800
 7650
 1150

150
 320
 120
 1150
 2055

320
 12
 60
 9
 66
 25

8925
 85
 375

552
 50
 28

101
 22

